VOL. 175 No. 7 DECEMBER, 1951

AMERICAN Gas Journal

B 335181

THE LIBRARY OF CONGRESS SERIAL RECORD

1952

DIAPHRAGM

Success Story

CHAPTER 1

Gas engineers took years of testing in service to determine whether VULCAN Molded Diaphragms meet the exacting requirements of the industry, and whether VULCANS afford worthwhile improvements and advantages.

CHAPTER 2

Today such benefits have been thoroughly proved. Thousands upon thousands of VULCAN Molded Diaphragms are in use, in all three types of gases, in all parts of the country. Engineers not only accept, but INSIST on specifying VULCANS in their meters...for greater accuracy, convenience and economy.

Vulcan

RUBBER PRODUCTS, INC.

FIRST AVENUE AND FIFTY-EIGHTH STREET • BROOKLYN 20, N. Y.

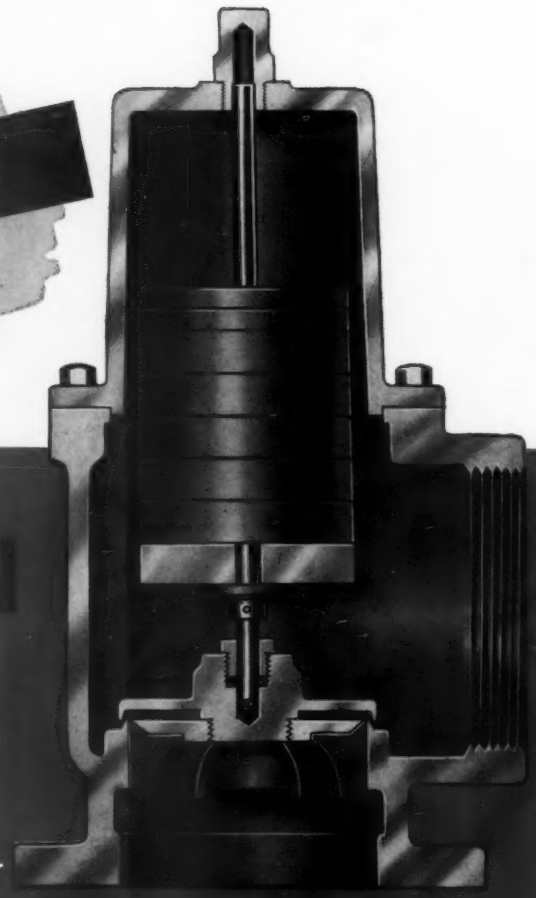
Safety

Good Performance

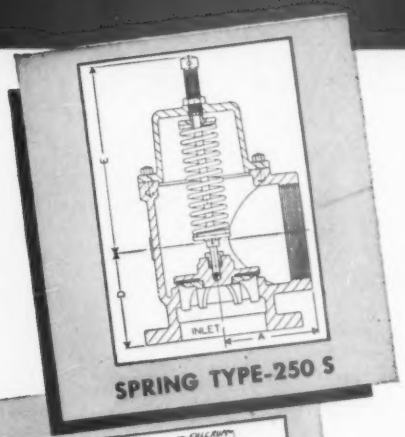
Easy Servicing

with

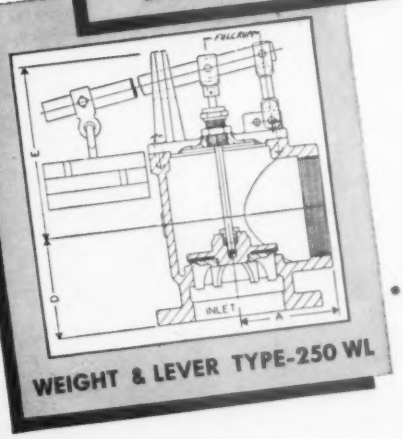
CHAPLIN-FULTON Safety VALVES



DEAD WEIGHT TYPE-250 DW



SPRING TYPE-250 S



WEIGHT & LEVER TYPE-250 WL

Assured protection against overpressure is an essential feature in *good pressure control.*

The *CHAPLIN-FULTON* Safety Valve provides accurate predetermined relieving pressures with known discharge capacities, plus leak-proof construction.

Available in three types covering a wide range of pressure settings.

ACCURATE CF MFG CO DEPENDABLE

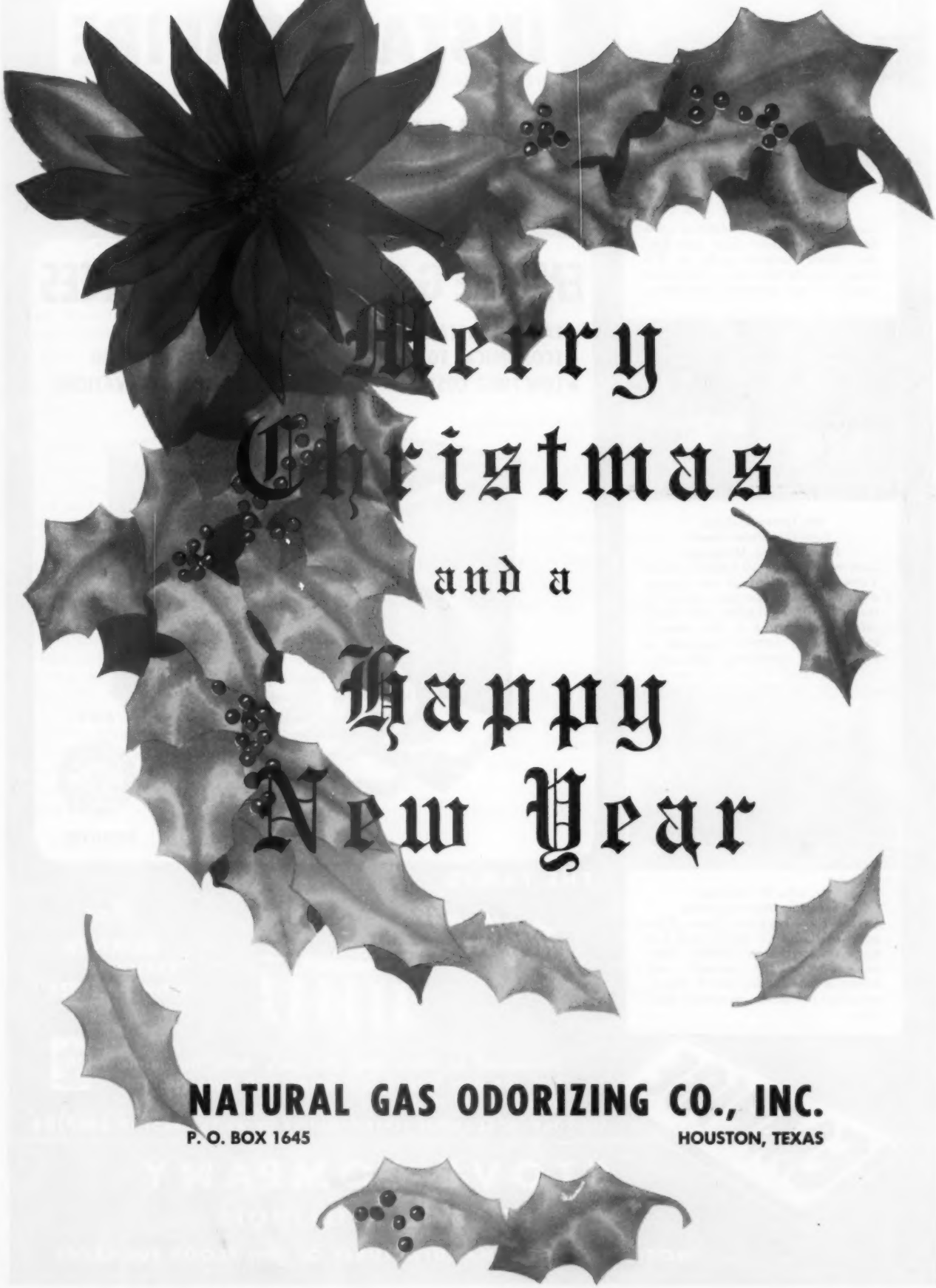
SV-50-1

Chaplin-Fulton

MANUFACTURING COMPANY

Pittsburgh 25, Pennsylvania

JAN - 8 1952
B 335181



NATURAL GAS ODORIZING CO., INC.
P. O. BOX 1645 HOUSTON, TEXAS

AMERICAN GAS JOURNAL, December, 1951. Vol. 175, No. 7. Published monthly (except August, then semi-monthly), by American Gas Journal Inc., at 73 Main Street, Brattleboro, Vt. Entered as second class matter January 24, 1950, at the post office at Brattleboro, Vt. under Act of March 3, 1879. Executive and editorial offices at 205 East 42nd St., New York 17, New York. Subscription prices, U.S. $3 per year; Canada $4; Foreign $10. Single copies 50 cents, except August 15 issue which is not sold separately. Printed in U.S.A.

INSTALL EMPIRE
AND
HAVE SATISFIED CUSTOMERS

WITH

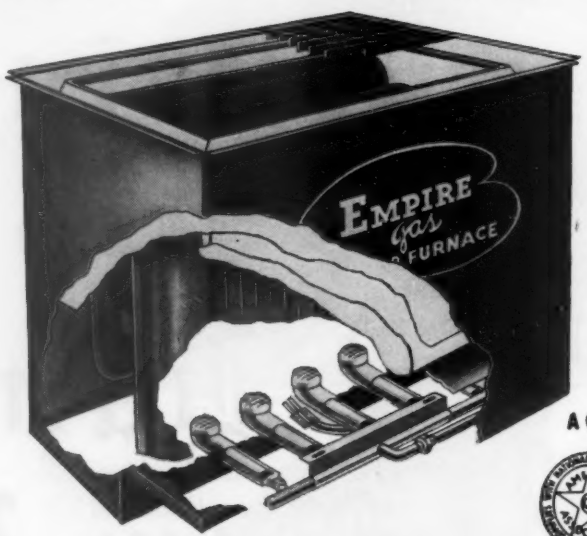
EMPIRE GAS FLOOR FURNACES

- EASY TO INSTALL
- ECONOMICAL TO OPERATE
- LOW FIRST COSTS
- NO BASEMENT NEEDED
- NO AIR DUCTS REQUIRED
- NO EXPENSIVE EXCAVATIONS

Mr. Cleon Lee, C. & L. Market
Logan, Utah
Says:—We are very thrilled with the clean efficient heat our Empire Floor Furnace gives us. We have become the envy of a great many of our grocery customers.

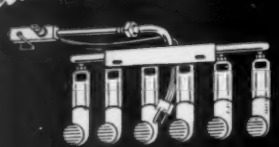
Mr. Tyman Jackson,
Twin City Motor Court
New Brighton, Minnesota
Says:—We have 30 Empire Floor Furnaces installed in our cabins and, outside of the very economical cost of operation, the most satisfying feature is the almost total lack of service required to keep them operating efficiently.

Mr. John W. Mosteller
Cherryville, North Carolina
Says:—The Empire Floor Furnace installed in my house has been in continuous service during the heating months and doing a wonderful, quick, clean, noiseless job at an amazingly low cost.



AGA
APPROVED

THE FAMED "Thriftmatic"



Gas BURNER "EXCLUSIVE WITH EMPIRE"

Developed to burn gas, the only fully automatic fuel, the new Empire Gas Burner will burn Natural, Mixed, or L-P gases.

SEE YOUR LOCAL EMPIRE REPRESENTATIVE OR WRITE DIRECT TO EMPIRE

EMPIRE

STOVE COMPANY
BELLEVILLE, ILLINOIS

WORLD'S LARGEST MANUFACTURER OF *Gas* FLOOR FURNACES

AMERICAN Gas Journal
ESTABLISHED 1859

VOLUME 175 DECEMBER 1951 NUMBER 7

This month...

G. M. Barris, publicity officer for the Eastern Gas Board, Radiant House, Clarendon Road, Waterford, England, wrote us that he would like to see specimens of some of the "house journals" of American gas utilities. He offers to arrange to exchange copies of his own Division *House Journal* if company publication editors are interested. With Churchill back in we thought it safe to send him a few names of editors whose wares we deem fit for the reflective British mind.

• • •

While we are in the Hands Across the Sea department, we might also mention that *Revue Générale du Gaz,* published in Brussels, Belgium, in its July-August issue reprints a chapter from our American Gas Fundamentals series. It is that one on *Procédés pour le reforming du gaz naturel*—in case any of our linguistically minded students are interested.

• • •

That gets us around to our monthly alibi for not having sent out the reprints of previous chapters of Fundamentals to all of the new subscribers who have requested them. The simple facts are the printer is now at work on a full set of reprints which will embrace the first ten chapters. He says two weeks will see them in the mail. And to mollify those of our readers who must be losing patience by now, we are enclosing them all in a punched and labelled folder that will be useful to accumulate future chapters. Printed in red, we might add, as befits the approaching Christmas season.

• • •

Two stories in this issue—Miami, on page 17 and Eastern Pennsylvania on page 18—deal with all gas promotions in which the LP gas industry and the gas utilities are cooperating in plugging the sale of modern gas appliances. Last month the Pacific Coast broke into print with news of a similar alliance. We hope the idea blankets the country, the obvious advantages of such cooperation having been too long overlooked.

Contents

Editorials .. 13
The Secret of Service
Cheesecake and Corn

Clinton ounty Transmission Line .. 14

Laclede's Cavalcade of Kitchens .. 16

All Gases Are One in Greater Miami Promotion .. 17

Utility, LP, Manufacturer and Supplier Cooperate in Eastern Penna. Sales Program .. 18

American Gas Fundamentals: Basic Gas Laws .. 19

Full Appliance Service Gives Brooklyn Borough Clean Bill of Health .. 23

Is 100% Natural Gas the Answer—E. G. Boyer .. 26

Index of Yields: Selected Utilities Stocks .. 32

New England Electric System Sells Gas Properties .. 33

Law Suits Involving Personal Injury Present Many Intricacies—Leo T. Parker .. 35

News of the Gas Industry .. 38

Elliott Taylor • Editor

Howard F. Weeks • Associate Editor

Charles R. Bellamy • Technical Editor

Arthur Rohman • Western Editor **John F. Falvey • Financial Editor**

AMERICAN GAS JOURNAL, established 1859, is published monthly except August, semi-monthly, by American Gas Journal, Inc., 205 East 42 St., New York 17, N. Y. ROBERT M. POE, President and Treasurer; ELLIOTT TAYLOR, Vice-President and Publisher; M. E. KELLEHER, Secretary and Assistant Treasurer.

ADVERTISING REPRESENTATIVES: JAMES C. MUNN, 2253 Delaware Drive, Cleveland 6, Telephone ERieview 1-1726; Jack O. Hodges & Associates, 479 S. Holt Ave., Los Angeles 48, Calif.; Geo. F. Haines & Associates, 2155 29th Ave., San Francisco 16. Member Audit Bureau of Circulations.

Copyright, 1951, American Gas Journal, Inc., New York, N. Y.

Subscription Rates: U.S. $3.00 per year; Canada, $4.00; Foreign, $10.00. Single copies, 50 cents. August 15 Handbook issue not sold separately.

A "Grand National" Winner... like Cast Iron Pipe...has

The Grand National Steeplechase, over a course of about 4½ miles with 30 jumps, is a rugged test of the *stamina* of a horse. Likewise, the test of time proves the *stamina* of cast iron pipe. For example, in more than 30 of the older American cities, cast iron water and gas mains are now in their second century of service. These sturdy mains are meeting changed conditions undreamed-of 100 years ago—in street traffic and in construction aboveground and underground. The resultant traffic shock and beam-stresses, cast iron pipe has taken in its stride, because of its shock-strength, beam-strength and crushing-strength.

No pipe, deficient in any of these strength-factors of long life, should ever be laid in paved streets of cities, towns and villages.

96%

OF ALL 6-INCH AND LARGER CAST IRON WATER MAINS EVER LAID IN 25 REPRESENTATIVE CITIES ARE STILL IN SERVICE.

Based on the findings of a survey conducted by leading water works engineers.

CAST IRON PIPE

STAMINA!*

* First run in England 112 years ago, the Grand National Steeplechase, over the famous Aintree course of 4 miles, 856 yards, was won in the record time of 9.20-2/5 by Golden Miller in 1934.

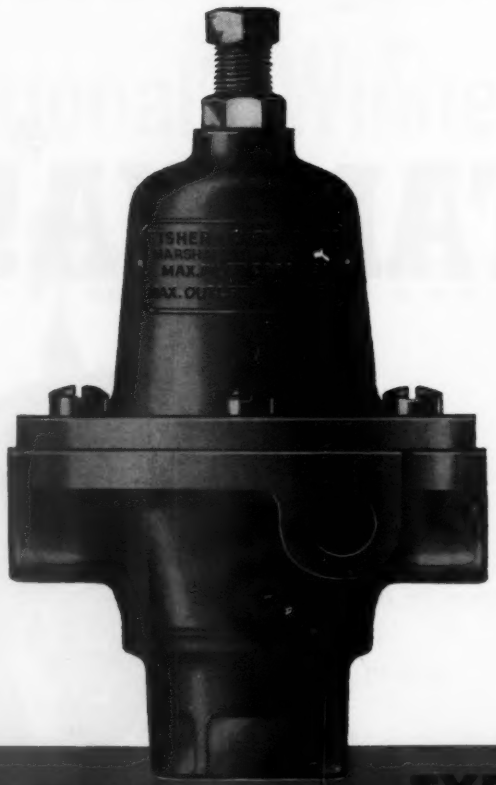
CAST IRON

CAST IRON PIPE RESEARCH ASSOCIATION; THOS. F. WOLFE, MANAGING DIRECTOR, 122 SO. MICHIGAN AVE., CHICAGO 3.

SERVES FOR CENTURIES

HIGH PRESSURE REDUCING VALVE for AIR or GAS SERVICE

INLET PRESSURE UP TO 3000 PSI
OUTLET PRESSURE 10 TO 150 PSI

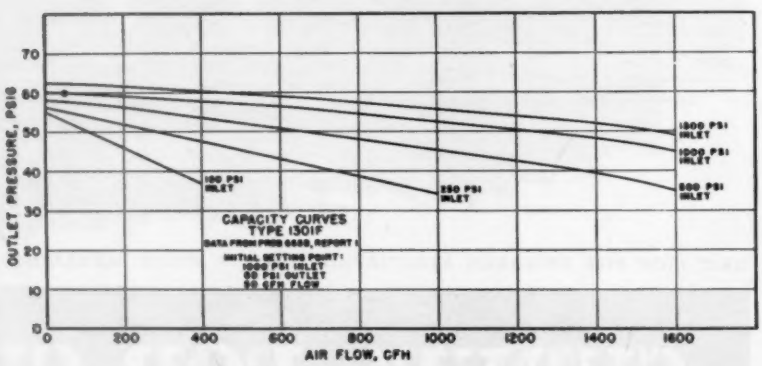


FISHER® **TYPE 1301F**

Type 1301F is commonly used in conjunction with pilot operated controllers where high pressure operating medium is used. They are also used in general industrial applications for high pressure reduction of non-corrosive air or gas.

CONSTRUCTION:
All forged bronze construction with glass impregnated Teflon valve disc, stainless steel orifice. Furnished with one inlet connection and two outlet connections of ¼" pipe size.

PRESSURE RANGE:
Suitable for inlet pressures up to 3000 PSI; reduced pressure spring ranges of 10 to 75 PSI; 50 to 150 PSI. Adjustment screw for easy adjustment of reduced pressure setting.

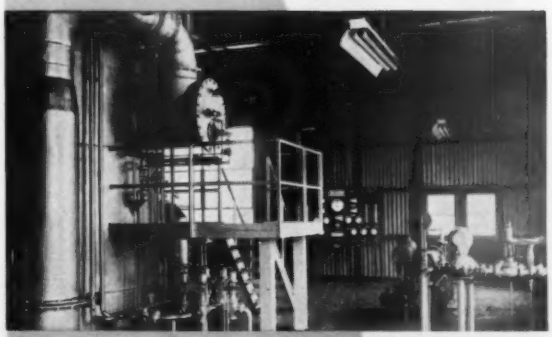


FISHER GOVERNOR COMPANY
Marshalltown, Iowa

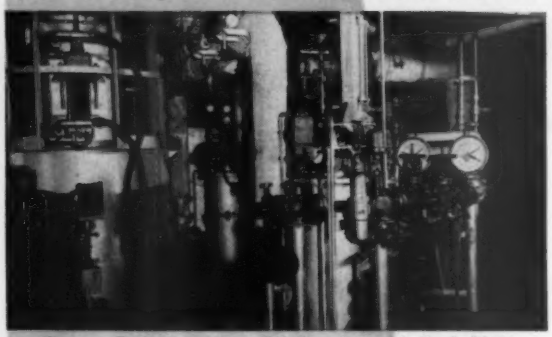
Achievement in...

HI-BTU OIL GAS

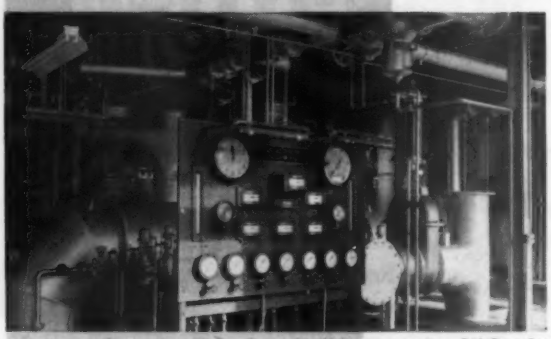
with HEAVY OIL



Top—Operating Floor, Two-Shell Regenerative Oil Gas Set.



Center—Twin-Generator Oil Gas Set with Back Blast.



Bottom—Operating Floor, Four-Shell Regenerative Oil Gas Set.

Oil and gas have flowed in abundant quantities since The Gas Machinery Company built the first four-shell oil gas set for A.G.A. research on heavy oil.

Following A.G.A. tests in 1948, we immediately initiated a development program in this field as a logical extension to the oil gas work which we had been doing for years with other gas oils. Specific requirements of gas utility companies called for variations in type of construction. Consequently, we developed a four-shell regenerative set, a two-shell regenerative set, and twin and single generator sets with back blast, any of which can be built from existing shells or can be entirely new construction.

Here are the results to date for equipment built for heavy oil by The Gas Machinery Company:

Number of heavy oil installations— operating	25 sets
Production to date, Hi-Btu Gas	10,500,000,000 Cu. Ft.
Heavy gas oil consumed	126,000,000 Gallons
Total savings in oil @ 3c diff.	$3,780,000

These heavy oil gas sets are in service *every day,* frequently on a 24-hour basis. The oils employed contain from 6% to 12% Conradson Carbon.

The Gas Machinery Company has also continued with the development and installation of oil gas generating equipment for peak load and standby purposes, using light or medium oils: A total of over 150 oil gas installations with generating capacity of 475,000,000 CFD. Consult us in confidence and without obligation on any problem relating to gas generation or auxiliary plant operations.

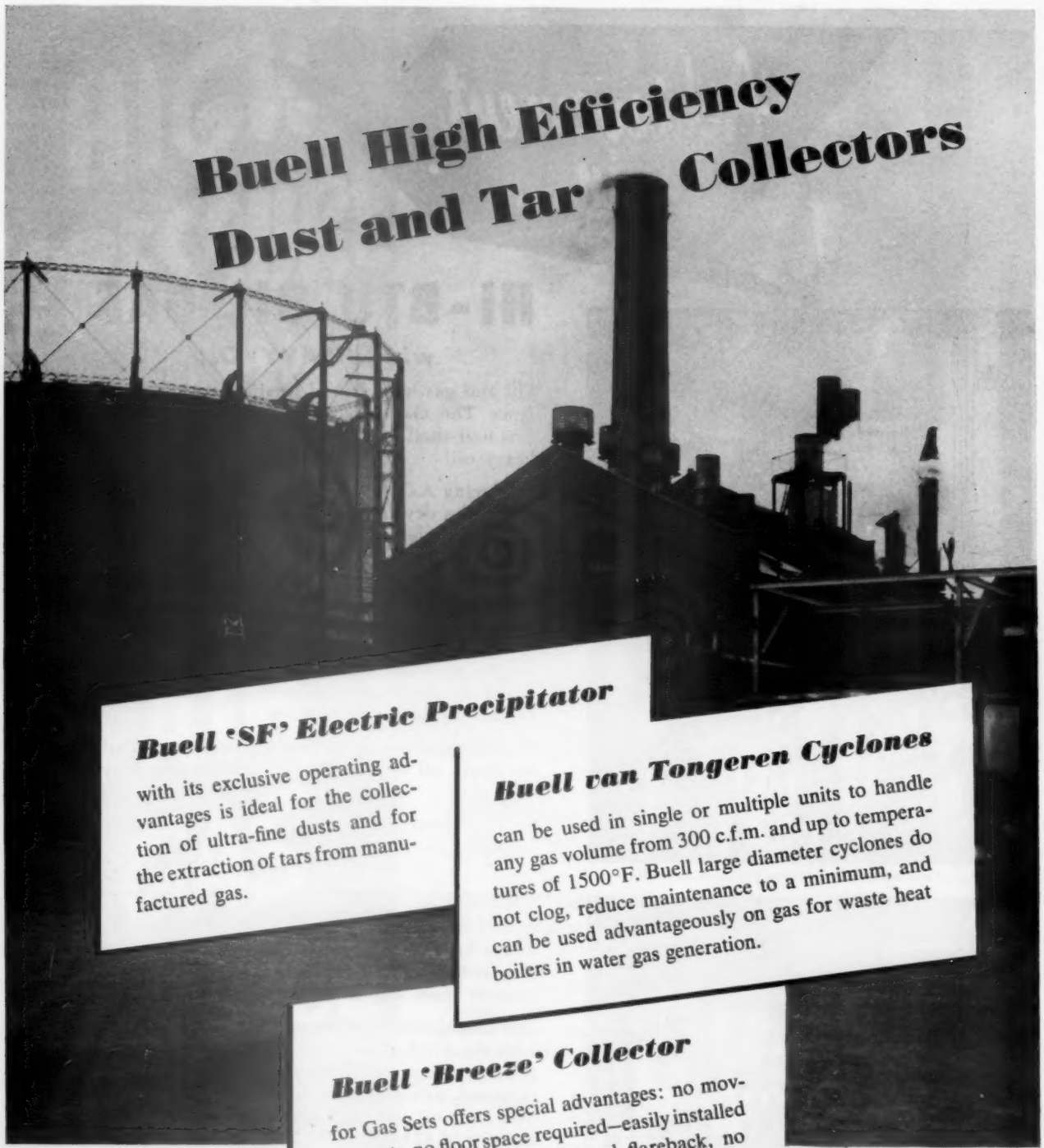
We are proud of our part in this contribution to the gas industry.

THE GAS MACHINERY COMPANY

16114 WATERLOO ROAD
CLEVELAND 10, OHIO

Designers • Fabricators • Erectors
GAS PLANT EQUIPMENT AND INDUSTRIAL FURNACES

THE GAS MACHINERY CO. (Canada) Ltd.
HAMILTON, ONTARIO



Buell High Efficiency Dust and Tar Collectors

Buell 'SF' Electric Precipitator

with its exclusive operating advantages is ideal for the collection of ultra-fine dusts and for the extraction of tars from manufactured gas.

Buell van Tongeren Cyclones

can be used in single or multiple units to handle any gas volume from 300 c.f.m. and up to temperatures of 1500°F. Buell large diameter cyclones do not clog, reduce maintenance to a minimum, and can be used advantageously on gas for waste heat boilers in water gas generation.

Buell 'Breeze' Collector

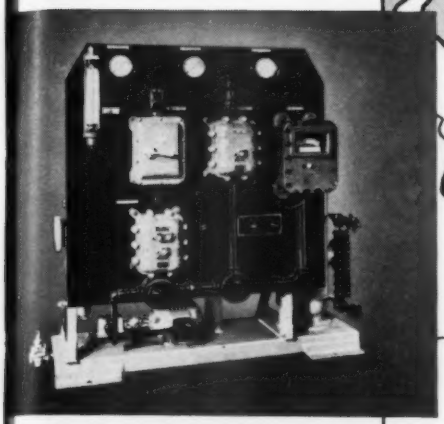
for Gas Sets offers special advantages: no moving parts, no floor space required—easily installed in existing plants, no additional flareback, no back pressure on superheaters, and no fans or motors.

ELECTRIC CYCLONIC

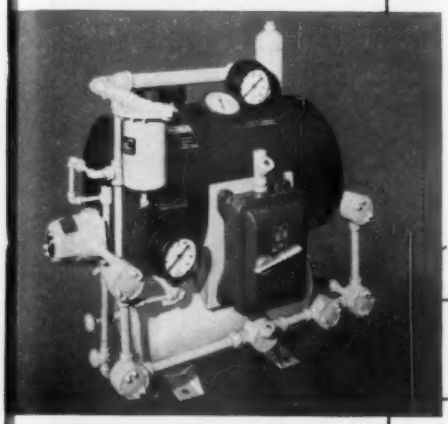
For more information as to your particular problem, contact
MULCARE ENGINEERING CO., INC.
55 Park Place, New York 7, N. Y.
Sole Representative in the Gas Industry for the Buell Engineering Company.

buell

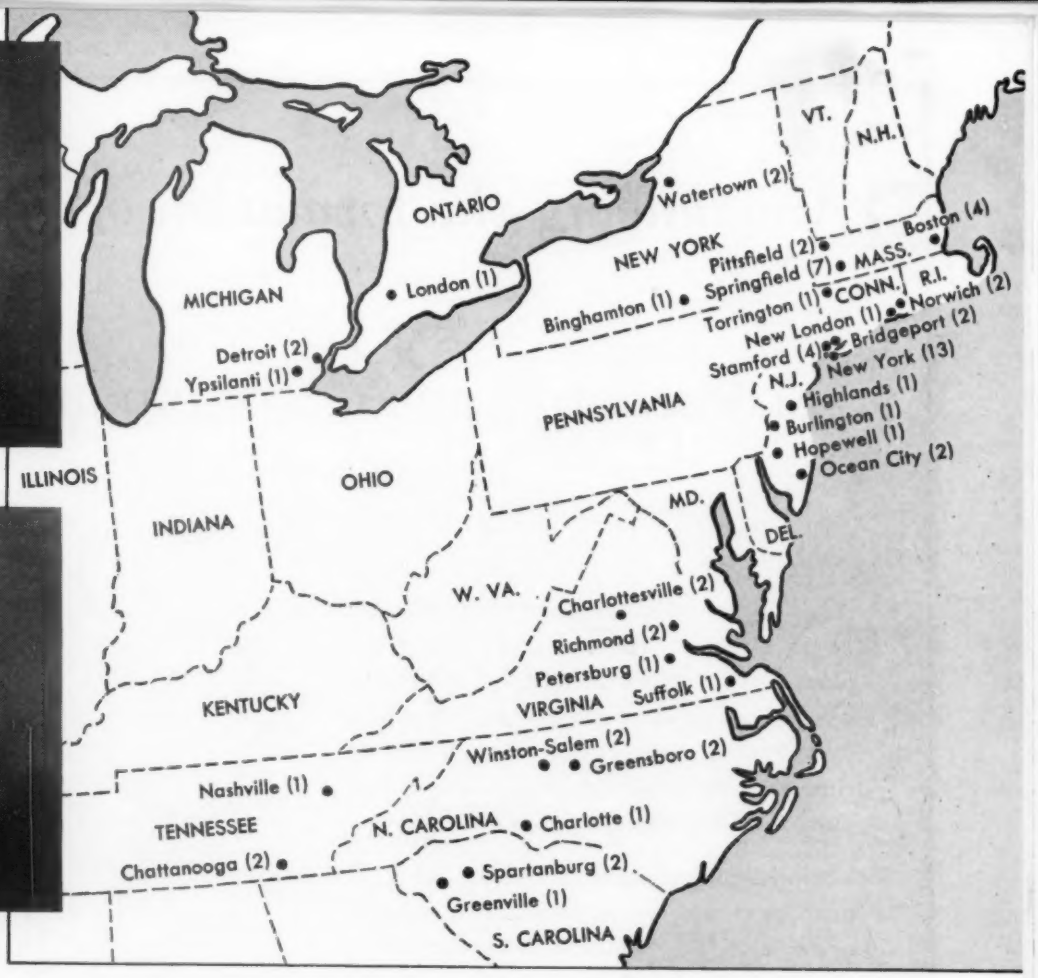
Engineered Efficiency in **Dust Recovery**



ELECTROIL FOGGER



PORTABLE FOGGER



PROOF that Gas Companies like the New BLAW-KNOX *Electroil* FOGGER

In less than a year more than 60 distributing points have improved their "customer relations" through the use of Blaw-Knox Oil Foggers.

Both the larger Electroil Fogger and the smaller Portable Fogger are safe, explosion-proof, shop-assembled units which solve many natural gas distribution problems through producing a stable oil fog in the gas stream . . . safely, automatically and with minimum attendance or supervision. Being shop-assembled units, they are ready to be connected "as is" to gas and electric power lines quickly and easily. For comprehensive data—

Write for Bulletin No. 2353.

GAS EQUIPMENT DEPARTMENT

BLAW-KNOX DIVISION

OF BLAW-KNOX COMPANY

2061 Farmers Bank Building • Pittsburgh 22, Pa.

SALIENT FEATURES

1. Simple to install.
2. Easy to operate.
3. Temperature control is completely safe and automatic.
4. Electrical equipment is explosion-proof.

IT WILL:

5. Produce a stable oil fog.
6. Wet down existing dust deposits.
7. Moisten leather diaphragms.
8. Coat inside of pipe with a protective oil film.
9. Prevent loss of odorant from reaction with pipe scale.

Announcing the formation of a:

GAS INDUSTRY MANUFACTURERS' AGENTS AND DISTRIBUTORS ASSOCIATION

An association of factory agents and distributors of gas appliances and equipment is now in the process of formation. Membership is open to independent self-contractors, doing business as manufacturers' agents or distributors, having exclusive territorial representation for one or more lines of gas appliances or equipment.

The primary purpose of the Association is to unite for mutual interest an important segment of the gas industry that is at present without an organized voice in industry affairs.

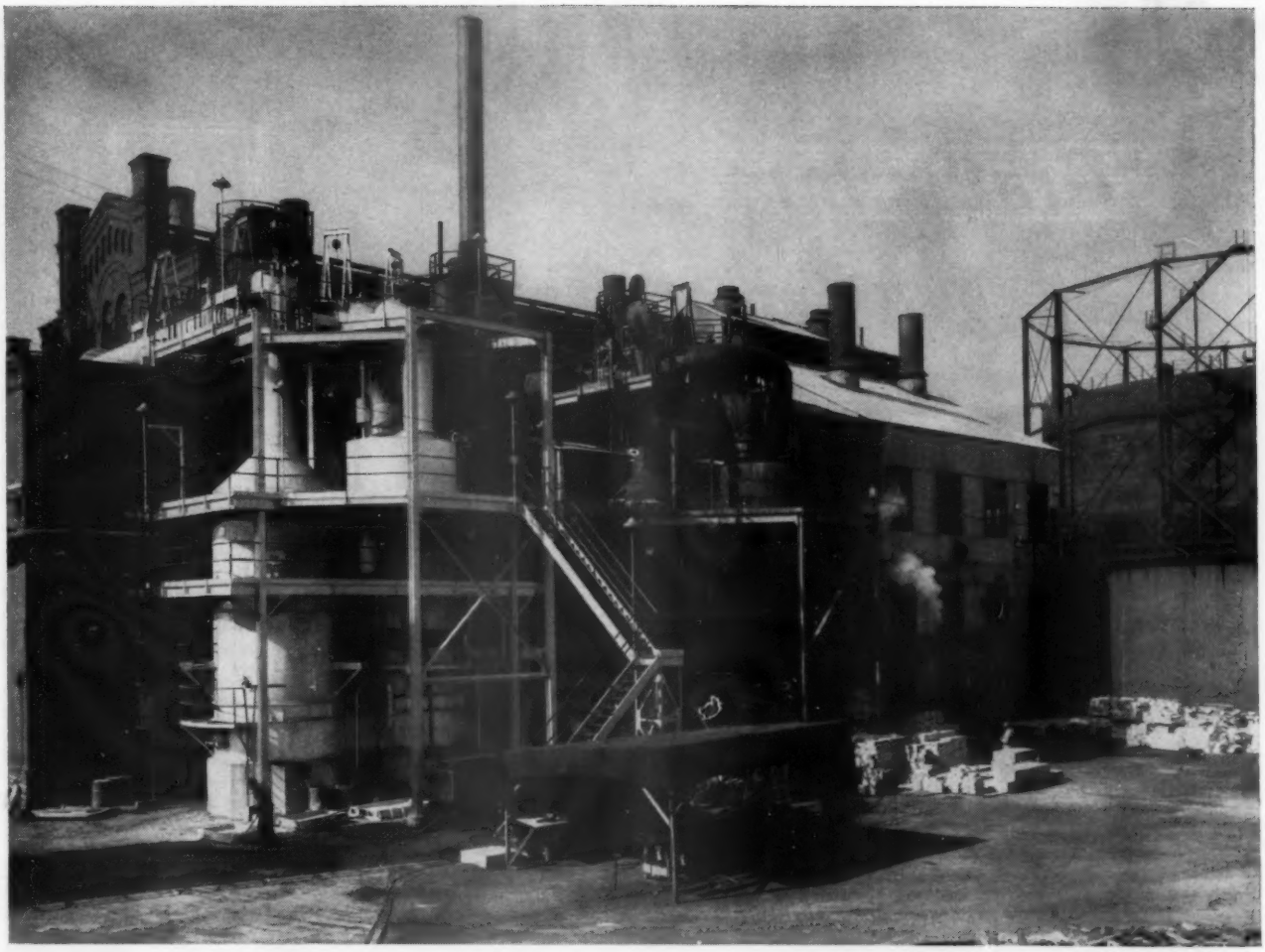
Cooperation with both manufacturers and utilities is one of the primary objectives of the organization. It will work for more uniform selling and distribution practices in the distribution of appliances and equipment. It will strengthen the industry status and standing of factory agents, fostering mutual helpfulness through the exchange of ideas and experiences.

Independent factory agents and distributors of gas appliance and equipment lines are invited to write for further information, including a statement of Policy and Objectives, to:
P. M. Maloney, Corresponding Secretary;

ORGANIZING COMMITTEE FOR:

AN ASSOCIATION OF GAS INDUSTRY
MANUFACTURERS' AGENTS AND DISTRIBUTORS

205 EAST 42 STREET, NEW YORK 17, NEW YORK



C.C.R. installations, The Philadelphia Gas Works Company, Station "B"

SERVICE-PROVED--C.C.R.

Since 1949, when the first U.G.I. Cyclic Catalytic Reforming* Process was placed in operation, one installation after another has followed. Up to the present, six have been completed and have fully demonstrated their effectiveness. Three more will be ready for service before the end of this year. Of these, three are converted carburetted water gas sets; others, new sets of 12′ 0″ 2-shell standard design. The experimental stage has been successfully passed, the advantages of C.C.R. definitely proved. These advantages are:

LOW INVESTMENT COST—modification of existing equipment or installation of new units is practical and economical.

LOW PRODUCTION COST—utilizes natural gas or L.P. gases.

FLEXIBILITY—interchanges with existing gas mixtures.

HIGH CAPACITIES—demonstrated on operations producing billions of cubic feet of sendout gas.

No matter what your project, we invite you to share our experience and facilities as designers, constructors and consulting engineers.

INSTALLATIONS OF U.G.I. CYCLIC CATALYTIC REFORMING PROCESS EQUIPMENT

The Philadelphia Gas Works Company	('49) Philadelphia, Pa.
Philadelphia Electric Company	W. Conshohocken, Pa.
The Harrisburg Gas Company	Harrisburg, Pa.
Consumers Gas Company	Reading, Pa.
Allentown-Bethlehem Gas Company	Bethlehem, Pa.
The Philadelphia Gas Works Company	('50) Philadelphia, Pa.
The Philadelphia Gas Works Company	('51) Philadelphia, Pa.
The Philadelphia Gas Works Company	('51) Philadelphia, Pa.
Rochester Gas & Electric Company	Rochester, N. Y.

*Patents Pending.

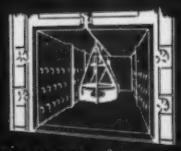
UNITED ENGINEERS & CONSTRUCTORS INC

NEW YORK 17 PHILADELPHIA 5 CHICAGO 2

WITH A BACKGROUND OF OVER SIXTY YEARS' EXPERIENCE

Gradiation®

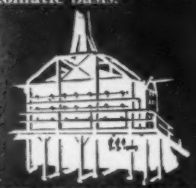
PRECISION TOOL FOR PRODUCTION WAR



HIGH SPEED radiant heat made possible the continuous heat treating of cast armor-plate for tanks with improved metallurgy.

FUNCTION FITTED radiant heat is speeding up forgings by one-third . . . is doubling die life.

DIRECT RADIANT heat has put heat processing of electronic glass tubes on a continuous, precise and automatic basis.



LIQUID HEAT TREATMENT of petroleum and chemicals assures more and better products . . . less space for equipment.

FAST DRYING with radiant heat . . . continuous strip of roofing felt, paper, textiles . . . paints . . . coatings . . . even instantaneous ink drying at paper speeds of 1000 fpm., *plus*.

SELAS GRADIATION offers American industry "*production-engineered processing*" . . . key to improved methods and product quality . . . assurance of new highs in output.

GRADIATION—the newest concept of high-speed heat processing—*proved* during World War II, *improved* since . . . utilizes radiant heat as a precision tool for increased production. Combines high-temperature, automatic operation, precise controllability and protective atmosphere. Where *production* depends on heat processing, let Selas engineers prove *Gradiation* saves manpower, time, material and money.

SELAS CORPORATION OF AMERICA

PHILADELPHIA 34, PENNSYLVANIA

Editorial:

The Secret of Service

THE Brooklyn Borough Gas Company is not the biggest of the utilities serving the New York Metropolitan area, measured by the yardstick of 100,000 customers. But it would be hard to convince us that any of its towering contemporaries can match its achievement in the matter of maintaining adequate customer service. That service policy has paid off in an enviable record of not a single death due to a faulty gas appliance since the company began keeping fatality records in 1938.

There is nothing complicated about the company's service policy. It maintains an adequate staff of well trained servicemen, it keeps some of them available on a twenty-four hour basis for emergency calls, and customers requiring service to appliances pay a minimum per hour charge for work performed.

Any gas company can do as much. The secret, we suspect, lies in the fact that everyone at Brooklyn Borough, from President Jeffords to the servicemen who make the calls, takes a conscientious and a responsible view of the gas company's obligation to its customers. And in so doing they have created an oasis of good will for gas, on the very edge of Manhattan's great public relations desert.

Cheesecake and Corn

PRESS agents, like rabbit dogs, even the best of them, sometimes lose sight of what they are out there for, and go baying down the wrong trail after anything from a woodchuck to a fieldmouse, which all may be lots of fun for a Beagle, but turns out disappointing as hell to the hunter.

We are moved to that philosophical preamble by the appearance in print of a new Gas Appliance Manufacturers Association publicity package that features "lovely" somebody or other, who has been named "best cook among the models by GAMA." In the course of our annual labors we are invited to all kinds of wingdings and shindigs by GAMA, but for some reason we were left off the command list for the performance that established the current winner of the cake cooking contest among models.

It must have been quite a shebang, judging from the picture of the winner, who was caught in an informal pose by a photographer just after she had crawled on top of a gas range and been handed up her winning confection, reliably described as a coconut cake. The cake in the photograph is a little skimpy in its dimensions, but no such acrid accusation could be levelled at the lovely little lady who holds it cupped in her competent hands.

There is quite a bit of her, plenty for the average taste, we should say; and as a tribute to her excellent judgment in selecting the proper attire for making the kitchen decorative as well as functional, only a negligible amount of her charms remain unrevealed. Sordid old hypocrites who caviled at the plunging necklines of television will do well to condition themselves for new and more seismic shocks when they see this one. This is no plunge. It is strictly a deep sea dive.

The rest of her attire, which seems to be just a swatch or two of voile or dimity, is starched and stands out real cute like, and appears to be cut so it can be used as a doily under the cake after the little lass gets down off the top of that stove and moves from there to the table, which we assume is to be her ultimate destination.

This picture, the accompanying caption advises us, is soon to appear in print as part of the campaign to publicize the sleek appearance and smooth operation of the modern automatic gas range. In our obtuse and mulish way, we refuse to be convinced that it will do any such thing. At the best it may awaken futile reminiscences among a few elderly editors; at the worst it can be damaging to the cause of gas appliances with thousands of women who resent having their creative art of fine cooking made the subject of bogus sexy promotion.

We have never subscribed to the theory that the public can be boobed or kidded or seduced into buying modern gas appliances. By and at large women do most of their cooking with most of their clothes on, and they seldom, if ever, stand on the stove, except maybe once in a while around New Year's Eve or at a birthday party.

Glamorous models don't fool them a bit. They know well enough that that girl can't cook, and they would just as soon not have her picture around when the old man should be sitting down to eat instead of stirring up another batch of martinis and mumbling vague excuses about having to go out for a little while after supper.

If it isn't too late, we believe GAMA should whistle the dogs back on this one and start them off on a fresh trail that might flush up a little legal game before it gets too dark to hunt. Cheesecake has its place; but not in the kitchen, boys. Please not right here in the kitchen.

Elliott Taylor

Columbia Gas System Pipe Line Taps New Pennsylvania Gas Area

by Staff Correspondent

MANUFACTURERS Light and Heat Company, an operating subsidiary of Columbia Gas System, has started the flow of gas through its new $11 million pipe line. It is the first direct connection between Pennsylvania's recently developed Leidy Field in Clinton County and the Pittsburgh consumer area. The new Clinton County line, started last April, was completed in November.

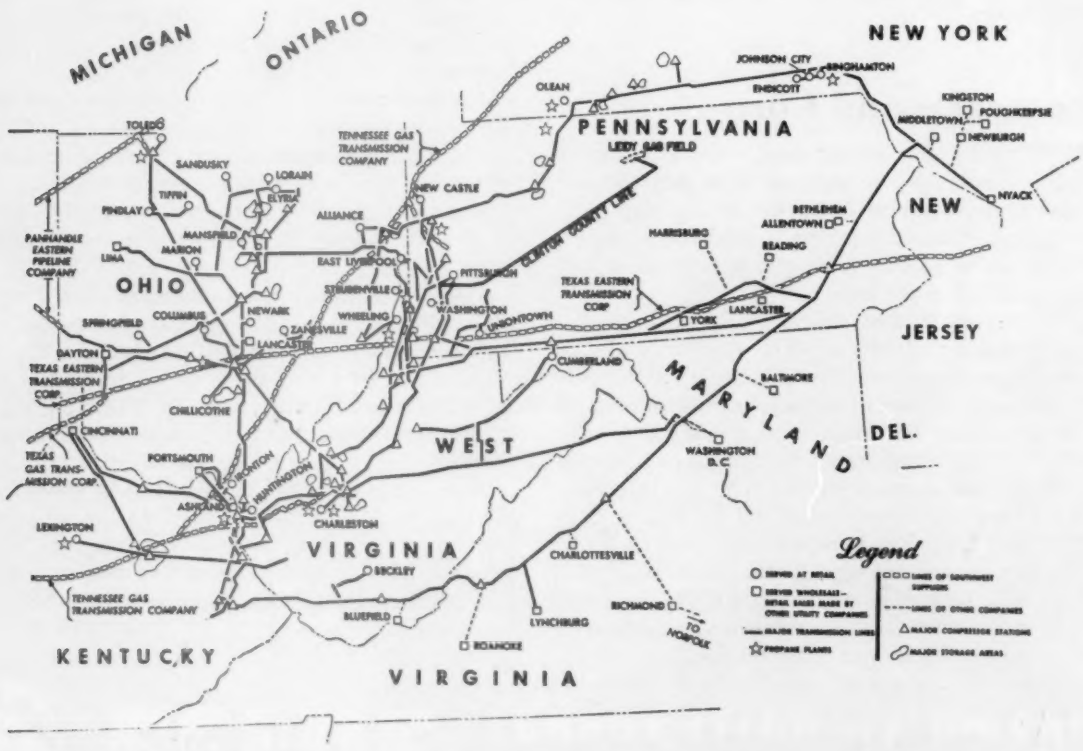
The 167-mile line comprises 140 miles of 16-inch pipe, 10 miles of 20-inch pipe and 17 miles of 24-inch pipe. A 2,640 horsepower compressor station and dehydration plant is being built at Gleasonton, near Leidy, at a cost of $790,000.

Pipe lines are routine equipment for a gas company, but the Clinton County line has caused much excitement among independent gas prospectors in Pennsylvania. In fact, the mushrooming wildcat development of the new gas fields in north central Pennsylvania has been watched anxiously, for the demand for natural gas today has developed a runaway tendency. Despite restrictions on servicing new customers and many other measures taken to increase the gas supply and limit the demand, there still may be a demand greater than the supply this winter if the weather is very cold. Consequently, development of a new gas field near large consumer markets is of considerable significance.

The critical gas situation is caused, not by a shortage of gas, but by a scarcity of pipe in which to transport it to market. A supply of gas less than 200 miles from a gas-hungry area such as Pittsburgh means that a comparatively short pipe line can supply a quantity of gas, whereas bringing additional gas from fields in the Southwest to the big eastern markets would mean first finding thousands of tons of scarce steel to build hundreds of miles of pipe line.

However, while the new Clinton County line will mean additional supplies of fuel for this area, it by no means is the answer to the runaway demand for natural gas.

The first deep gas well to be drilled in



Map of Columbia Gas System showing location of the Leidy gas field and the Clinton County line recently completed by the Manufacturers Light and Heat Company, which is part of the Columbia Gas System.

A back hoe anchored to a hillside by cable attached to a bulldozer clears a ditch in a creek bed near Phillipsburgh.

A long view of the Clinton County line snaking over the Pennsylvania hills. Welding inspectors check section joints.

Clinton County came in on January 8, 1950, when Dorcie Calhoun, a farmer drilling on his own property, struck gas at 5661 feet for an estimated original openflow of 15 million cubic feet daily. That first well in Leidy gas field opened up the easternmost source of major gas production so far discovered. It is one of the most important developments in the Appalachian area in recent years.

In order to take advantage of what promised to be an excellent source of gas, The Manufacturers Light and Heat Company of Pittsburgh, one of Columbia's principal operating companies, leased approximately 200,000 acres of land in the north central area of Pennsylvania and has other acreage under contract to buy gas from companies developing it. Manufacturers also is receiving from that area 25 million cubic feet of gas a day from Trans-Penn Transit Corporation. What's more, Columbia is drilling a test well on the Ferney Dome, about 25 miles southeast of Leidy Field in Clinton County, and plans to drill many others.

Construction of the line began in April after several more good wells had been brought in, adding considerably to Leidy's proved gas reserves.

Meanwhile, geologists had found a number of structures similar to the Leidy structure nearby. With these prospective reserves added to the proved reserves of Leidy, the investment of $11 million to build a pipe line to this new supply was warranted.

As of October 12, 1951, a total open flow of 595,943,000 cubic feet daily had been developed from 55 productive wells. At that time 48 more wells were being drilled and 14 additional locations had been made. Interests which supply the Clinton County line have developed 18 of the productive wells with a total open flow of 188,025,000 cubic feet daily. They are drilling 43 others and have made 13 locations in the field.

Because many domes and anticlines in which gas is most likely to be found lie principally to the south of Leidy field, Columbia's new pipe line was constructed through that general area in order to serve as many wells as possible in the future.

As always, there were numerous difficulties. The steel shortage made it difficult to find an adequate supply of pipe, but persistent effort located all the pipe needed for the Clinton County line early in October.

Mountainous terrain also presented drawbacks. Rivers, always obstacles to the pipeliner, added to the problems, for the Clinton County line crosses five of them: the Monongahela, Youghiogheny, Loyalhanna, Conemaugh and the west branch of the Susquehanna. Fortunately the weather remained mild.

Originating ten miles east of Renovo in Clinton County, the new line runs southwest through Pennsylvania's rugged forest lands to connect with previously existing lines in Westmoreland, Allegheny and Washington Counties near Pittsburgh, terminating near Canonsburg.

Construction of the Clinton County line is one of ten major steps Columbia Gas System has taken to protect the 2½ million homes it supplies directly and through other utilities in a year of unprecedented demand for natural gas.

AGA Executive Tax Committee Holds Organization Session

An organization meeting of the American Gas Association Executive Committee on Taxation was held in St. Louis during the recent annual convention of the association. Chairman Robert A. Hornby, executive vice-president, Pacific Lighting Corporation, San Francisco, described the formation of the committee and outlined its purposes.

Organized by directive of the Executive Board of AGA, the committee will relieve the AGA Defense Committee of taxation problems. The committee will formulate policy on pursuing tax matters before Congress. It will utilize the present Taxation Accounting Committee of the Accounting Section of AGA as its technical staff to set up reports and recommendations.

Members of the committee in addition to Mr. Hornby are: M. A. Abernathy, vice-president, United Gas Pipe Line Company, Shreveport, La.; James Comerford, vice-president, Consolidated Natural Gas Company, New York; E. H. Eacker, president, Boston Consolidated Gas Company, Boston; Frank L. Griffith, vice-president and comptroller, The Peoples Gas Light and Coke Company, Chicago; William N. Grinstead, president, The Ohio Fuel Gas Company, Columbus; Lyle McDonald, vice-president and comptroller, Public Service Electric and Gas Company, Newark; Fred W. Peters, vice-president and secretary-treasurer, Oklahoma Natural Gas Company, Tulsa; W. T. Stevenson, president, Texas Gas Transmission Corp., Owensboro, Ky.; and Claude A. Williams, president, Transcontinental Gas Pipe Line Corp., Houston.

George H. Smith, assistant managing director, AGA, will serve as secretary of the new committee.

Laclede's
CAVALCADE OF KITCHENS

Some of the all gas kitchens which Laclede Gas Company has designed to show St. Louisans the best and latest in modern kitchen planning.

(See opposite page for detailed descriptions)

ALL GASES ARE ONE
In Greater Miami Promotion

Rudi Rada

GAS INSTITUTE MEMBERS MAP CAMPAIGN

Left to right: J. Kennard Johnson, Sam Coolik, Sid Langer, L. B. Stokesberry, L. R. Chandler, H. P. Thomas, J. A. Garfield, and D. N. Mainguy.

THE Gas Institute of Greater Miami, organized in the summer of 1950 following many weeks of preliminary talks amongst several of the leading gas company members, has completed one year as the first cooperative gas group of its kind in the United States.

The determination of a handful of gas men to put their industry upon a unified competitive basis with the electric utilities has grown into a cohesive, hard-hitting group encompassing as members every LP gas distributor in the area together with The Peoples Water & Gas Company and the Gas Division of the Florida Power and Light Company.

Basically, the principles of The Gas Institute of Greater Miami consist mainly of passing on to the public factual information concerning gas. No "direct" selling of appliances by brand name is attempted, but messages of an institutional nature sell the six big jobs of gas . . . gas for cooking, refrigeration, water heating, room heating, incineration and clothes drying.

LACLEDE KITCHENS

(shown on opposite page)

(1) This is the Gas Kitchen and Laundry as designed by The American Home and featured in the October Issue of that magazine . . . here in this 10x20 foot space, there is a fine kitchen, snack bar, a laundry, and sewing room . . . and a fully automatic gas range, a gas refrigerator, a gas clothes dryer . . . (2) the Heart-Saver Kitchen, as planned by the Woman's Home Companion and featured in the October issue of this magazine, is worked around modern gas appliances to help the ladies take it easy in dozens of little ways as well as big ones and is designed to avoid every unnecessary strain . . . (3) another glimpse of The American Home Kitchen showing, in particular, the Servel gas refrigerator . . . (4) there is the water heater tucked away in the kitchen that really works, featured by McCall's magazine in its September Issue. Everything is behind doors in this attractive room. And (5) shows the same kitchen, through the sliding doors that open breakfast bar into a dining area.

In the Florida picture, the weather with its hurricane season, the few winter days when heat is needed and the over-all climate requiring unfailing refrigeration offers the gas industry a challenge that is easy to meet. True facts showing what happens when storms knock out the electric utilities have been employed with good effect. The Gas Institute has endeavored to place these facts in such a way that they appear to be more "institutional" in nature than commercial. In addition, surveys, both local and those taken from national figures are used from time to time to emphasize the messages. Facts on the superiority of gas for modern living have gone out to the architects and contractors, endeavoring to get them to specify gas during the design stage, proving it is less expensive at this time and increases resale value of the house if a gas outlet is installed parallel to the electric one.

Although a budget was originally set up for approximately twenty thousand dollars the first year, an amount in excess of twenty-five thousand was spent during this time. The various members of the Institute pledged amounts depending on the size of their business. The Institute was incorporated, with officers and directors being elected for each year. A committee was formed at the outset to handle general business and to meet with the advertising agency once a week to cover details of advertising. Agency selected from a group of agencies to handle the account is the Mainguy-Sheppard Corporation of Miami. Material is prepared and submitted to the committee at weekly meetings although the newspaper schedule is prepared several weeks in advance. Differing from most advertisers, for whom campaigns are prepared many weeks and even months in advance, the nature of the Institute's messages are such that advertisements are readied sometimes at a moment's notice to cope with a sudden weather change, especially during the hurricane season. Material is kept on hand, of course, for release to newspapers, radio, TV and for dealer distribution for these emergencies.

Media selection included newspapers, radio employing five Miami stations, four of them network, television, trade paper, direct mail and special promotions such as two-color silk screen pennants to fly from the trucks of the gas companies. Mailings to architects and contractors supplying them with specially prepared information are a regular monthly feature. Information includes facts on gas installation for both manufactured and bottled gas, the availability of gas appliances by company name and brand name and other data which the architect did not have until the Gas Institute took over.

One of the most successful TV live shows in the area is the "Queen of Clubs" every Tuesday morning, sponsored by the Gas Institute. This show, now in its seventh month, was originated by Vi Stokesberry, is directed to the women's clubs of Greater Miami, of which there are in excess of 550. Each show interviews one or more clubwomen who have an opportunity of telling of the activities of her club in a philanthropic way. A "Queen of Clubs" is chosen for the week and she receives an orchid. Also, one

club each week receives a hand colored replica of a parchment scroll, framed ready for hanging on the clubroom wall. The message thanks that woman for appearing as guest on the TV show and further recognizes that club's charitable activities. The public relations value of this gesture has already paid off, and there is a long list of clubwomen wanting to be interviewed on this program.

On this same program the Gas Institute held a contest which ran for several weeks, offering as prizes three fully automatic gas appliances. As judges, the Institute was fortunate in having Frank Watson, president of the Florida American Institute of Architects, C. E. Hamer, president of the Draftsmen's club of Miami, and Perry Willets, vice-president of the Builder's Association of South Florida, all of whom appeared on the program the day the winners were announced and interviewed. In short, the Gas Institute has gone all out to reach the man who specifies . . . the architect, and the man who builds . . . the contractor.

Radio has played a vital part in the picture of the Gas Institute of Greater Miami . . . in getting facts on gas to the public. In addition to a special one minute recording featuring a singing commercial, chain breaks and 12 word spots hammer away continuously on the "always dependable" theme in *any* weather, or on the superior "fast-recovery" of gas. Special "hurricane spots" sponsored by the Institute direct from the weather bureau take over when an alert hits town. General theme at this time is dependability, of course, in any weather, and further, that with a *gas* refrigerator, food will not spoil, and meals will be on time as usual.

As for results of the first year in business, best reaction seems to be that there has been 100 per cent support for the second year, with pledges from *every* member of financial contributions. In addition, companies outside of the Greater Miami area are continually seeking advice and information with an eye to starting a group in each one's area. The Key West Gas Company, although 167 miles south of Miami, is a member of the Institute, an indication of the impact increasingly being felt in an ever-widening circle from the advertising efforts of the Gas Institute.

A summation would indicate without any doubt that the hard-hitting efforts of the Gas Institute show in the stepped up business of each member. Recognition of gas and gas appliances is rapidly being achieved through the fine team-work of the gas men. By placing the advertising and promotion on a high plane, the Gas Institute of Greater Miami has established a firm footing for the gas industry in South Florida.

Utility, LP, Manufacturer, Supplier Cooperate In Eastern Penna. Sales Program

A GAS industry advertising and promotion campaign for Eastern Pennsylvania, which will be signalized by cooperation, for the first time in the area, between the LP gas industry and the gas utilities is in the making with the first installments of radio newspaper and billboard presentations slated for appearance in January 1952.

The plan, announced publicly at a luncheon meeting in Philadelphia on November 16, has already been assured the support of stove, water heater and other appliance manufacturers, propane gas producers, bottled and tank gas dealers and twelve gas utilities in the area from Center County east to the New Jersey line.

The initial budget has been set at $150,000 and the promotional committee, headed by Frank H. Trembly, Jr., of The Philadelphia Gas Works Company, expects to raise the sum from the following sources:

Gas utilities	$45,000
LP gas interests	30,000
Appliance manufacturers	30,000
Suppliers of equipment	45,000

The campaign is the outgrowth of months of study, during which time extensive surveys were made of existing gas customers, former gas customers who had turned to electric cooking, and gas customers who had been regained to the industry after switching from gas to electricity.

Trained interviewers through adroitly worded questions ascertained not only the reasons for customer desertion, but also succeeded in obtaining a composite housewives' opinion of the merits of gas compared to electricity for cooking and water heating. They discovered, as had been frequently stated, that one of the principle reasons for the rapid rise percentage wise of electrical usage has been that the industry has consistently outadvertised and outpromoted gas in every department.

Retailers and dealers were also "shopped," and these forays uncovered what the committee analyzed as an apathetic interest in gas appliances on the part of many retailers who have both gas and electric equipment for sale.

(Continued on page 36)

American Gas Fundamentals

OUTLINE

Natural Gas
- *Geology
- *Drilling and Completion

Manufactured Gases
- *Coke oven gas; producer gas, blue gas; carbureted water gas
- *Reformed gas
- *Hi-Btu oil gas

Basic Gas Laws
- Perfect Gases
- Supercompressibility

Transmission
- *Pipe lines
- Corrosion and pipe protection
- Compressor stations
- Hydrates and dehydration
- *Gas conditioning
- Flow formulae
- Orifice meter measurement

Gas Storage
- *Methods of storing gas

Gas Distribution
- System design and operation
- *Pressure Regulation, Part 1
- *Pressure Regulation, Part 2
- *Metering

Gas Distribution
- System design and operation
- Pressure regulation
- Measurement and accounting

Gas Utilization
- Combustion characteristics
- Domestic
- Commercial and industrial
- Interchangeability

Conversion Practices

Management Problems and Policies
- Corporate structure
- Public utility regulation
- Public relations

*** Indicates chapters that have been printed since January 1, 1951; available without charge to new subscribers to American Gas Journal.**

How to Use the Material

American Gas Fundamentals *is a comprehensive compilation of basic gas facts to guide any gas utility employee toward a broader understanding of the industry as a whole. It is written in layman's language so that the technical fundamentals of every subject treated may be digested and understood by the non-technical reader.*

The series is designed to be removed from each current issue of AMERICAN GAS JOURNAL *and filed in a ring binder where it may be accumulated into a text book of permanent usefulness. Material should be filed under the major subject head appearing in the upper right hand box at the head of each chapter.*

Perfect Gases

LIQUIDS and gases are fluids. A liquid is a fluid of such nature that if a certain volume be introduced into a vessel of greater volume, it occupies a portion of the vessel equal only to its own volume. A gas is a fluid of such nature that if a certain volume be introduced into a vessel, whatever the volume of the vessel may be, the gas will distribute itself throughout the vessel.

That mutual attraction which is exerted between all particles of matter, at all distances, is called gravitation. Gravitation is universal; that is, every molecule of matter attracts every other molecule of matter in the universe. The whole force with which two bodies attract one another is the sum of the attractions of their molecules, and depends upon the number of molecules contained by the two bodies collectively, the mass of each molecule, and the distance between the bodies. What is understood by the weight of a body is the mutual attraction between it and the earth.

The increase of pressure attending the increase in depth, in both liquids and gases, is readily explained by the fact that the lower layers of fluids sustain the weight of all the layers above. Consequently, if the body of fluid is of uniform density, as is very nearly the case in liquids, the pressure will increase in nearly the same ratio as the depth increases. But, in consequence of the extreme compressibility of gaseous matter, the atmosphere is far from being of uniform density.

Elasticity of Gases—Closely allied to compressibility is the elasticity of gases, or their power to recover their former volume after compression. The elasticity of all fluids is perfect. In other words, the force exerted in expansion is always equal to the force used in compression; or, however much a fluid is compressed, it will always completely regain its former volume when the pressure is removed.

Expansion of Gases—This property of gases, distinguishing them from other fluids, may be explained by the following examples. If we have two equal closed vessels connected by a tube which can be closed by means of a cock, and one of these vessels is filled with air at the ordinary pressure while the other does not contain any matter, or, in other words, has a vacuum inside, then, on opening the cock, the air immediately expands and rushes into the second vessel until there is the same quantity of gas in each vessel. By again closing the cock and exhausting the air from one of the vessels by means of an air-pump, and then opening the cock, the remaining gas again expands and fills the two vessels. This operation may be repeated indefinitely, and in every case the gas left in the one vessel will, when the tap is opened, expand until it fills both vessels.

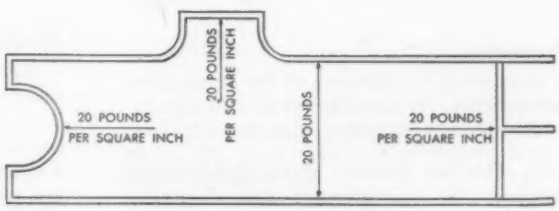
Pascal's Law—An external pressure applied to a fluid is transmitted equally in all directions, or the pressure on each unit of area exercised inward upon a mass of fluid is transmitted undiminished in all directions, and acts with the same force upon all surfaces in a direction at right angles to those surfaces. Hence the pressure applied to any area of a confined fluid is transmitted, without diminution, to every other equal area through all the fluid to the walls of the containing chamber as shown in the diagram.

According to this law, the gas pressures in the various parts of a "continuous and connected reservoir" are nearly equal. The total pressure acting upon any definite portion of the surface is equal to the pressure exerted by the depth of fluid plus the effect of the external pressure, which is transmitted by the fluid.

Units of Measurement

The fundamental gas laws express the relationship between the pressure, volume, and temperature of ideal

DIAGRAM ILLUSTRATING PASCAL'S LAW.



gases. The pressures are designated in several different ways:

Pounds per square inch
Ounces per square inch
Inches of mercury
Inches of water

In natural gas fields, in high pressure lines, and in intermediate pressure distribution systems, pressures are usually expressed in pounds per square inch; ranging from very high pressures of 2000 pounds or more in the field, to as low as two pounds in intermediate systems in cities and towns.

In many instances, the gas is distributed at 15 pounds pressure, and the pressure is subsequently reduced by regulators at the consumers' premises to low pressure, expressed as ounces or inches of water. In other localities, the gas flows from an intermediate pressure system through reducing regulators into the low pressure system where the gas pressure may be at any constant value from a few ounces per square inch to three inches of water.

In the natural gas business, the pressure of the cubic foot as the basis of measurement is sometimes four ounces per square inch. In other instances, it may be eight ounces or 10 ounces above an absolute atmospheric pressure of 14.4 pounds per square inch.

In the usual definition of the standard cubic foot in the manufactured gas business, pressure is expressed in inches of mercury, usually 30 inches of mercury absolute, when the mercury is at a temperature of 32 degrees F.

Pressure Conversion Factors

A table of approximate conversion factors is as follows:

One pound per square inch	=	27.7	inches of water
	=	16.0	ounces per square inch
	=	2.04	inches of mercury
One ounce per square inch	=	1.73	inches of water
	=	0.128	inch of mercury
	=	0.063	pound per square inch
One inch of mercury	=	13.6	inches of water
	=	7.8	ounces per square inch
	=	0.49	pound per square inch
One inch of water	=	0.58	ounce per square inch
	=	0.074	inch of mercury
	=	0.036	pound per square inch

In the natural or manufactured gas business, volume is expressed in cubic feet.

The temperatures are expressed in degrees on the Fahrenheit scale, on which scale the freezing point of water is 32 degrees F, and the boiling point of water at sea level is 212 degrees F. The scale is divided into 180 divisions between the boiling point of water and the freezing point of water.

When making calculations by means of fundamental gas laws, absolute pressures and absolute temperatures are used.

Atmospheric Pressure

Atmospheric pressure is the pressure of the atmosphere at some definite location. At sea level it is 14.7 lbs per square inch or 760 mm (30 inches) of mercury.

Static pressure—The line pressure above or below the atmosphere is known as the static pressure or standing pressure, to distinguish this pressure from the differential pressure which is a pressure difference due to flow.

Vacuum—The ordinary use of this term means merely a partial diminution of pressure below the normal atmospheric pressure, or zero gage pressure.

Absolute Pressure

The gage pressure is the value read on the ordinary pressure gage. The absolute pressure is the pressure above a perfect vacuum. A perfect vacuum is the zero of absolute pressure. Absolute pressures greater than atmospheric pressures are equal to the gage pressure plus the atmospheric pressure, the pressures being expressed in the same units. The absolute pressure corresponding to a vacuum reading or pressure less than atmospheric pressure is equal to the atmospheric pressure minus the gage pressure, both pressures being expressed in the same units.

The absolute pressure, or pressure absolute, is defined as the total pressure acting upon a surface. To express gage pressures above atmospheric pressure in absolute units, the atmospheric pressure must be added to the gage pressure. For example, if the gage pressure is 10 pounds and the atmospheric pressure is 14.4 pounds, the absolute pressure is equal to 10 + 14.4 or 24.4 pounds. Likewise, a line pressure of 20 inches of mercury is equal to an absolute pressure of 20 + 29.32 or 49.32 inches of mercury, where the atmospheric pressure is 29.32 inches of mercury (which is 14.4 pounds per square inch).

While readings less than atmospheric pressure are indicated in inches of mercury, the scales or gages could be divided so as to read in pounds per square inch. For instance, on an ordinary gage, five inches of mercury vacuum is approximately —2.5 pounds, or 10 inches of mercury vacuum is —4.9 pounds. Therefore, if the atmospheric pressure is 14.4 pounds per square inch absolute, and the reading is five inches of mercury vacuum, the absolute pressure is equal to 14.4 pounds minus 2.5 pounds, or 11.9 pounds.

Absolute Temperature

Absolute temperature is the temperature reckoned from the absolute zero.

Absolute zero is the temperature at which a gas would show no pressure if the general law for gases should hold for all temperatures. It is equal to —459.72 F, commonly considered —460 F.

Ideal and Actual Gas Laws

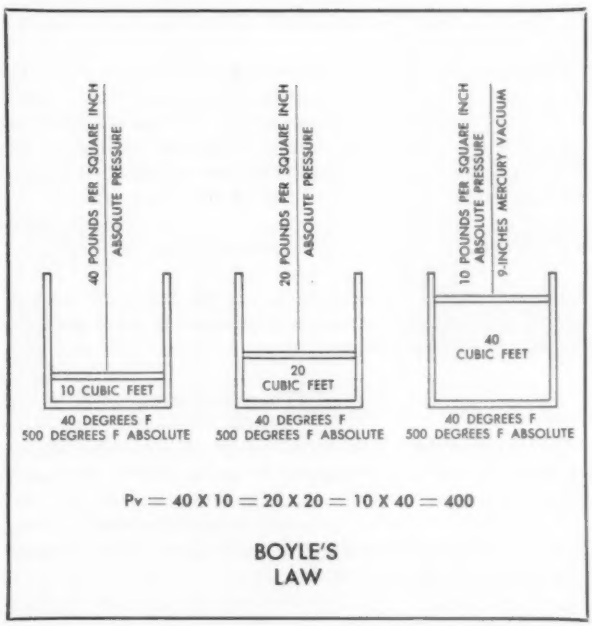
The laws of gases may be divided into two groups, the ideal laws and the actual laws. The ideal laws, or laws of ideal gases, do not apply exactly for any real gas, but hold with sufficiently close approximation for engineering principles for all gases which are in a state far removed from liquefaction, such as hydrogen, nitrogen, and oxygen.

Fundamental Gas Laws

Boyle's and Charles' Laws may also be illustrated in the following manner:

In the illustrations which follow, showing by diagram the action of the various laws of perfect gases, we assume a cylinder which is a non-conductor, fitted with a frictionless piston fitting so closely that it does not permit the escape or entrance of any gases. In each instance the weight of gas contained in the cylinder is the same. It will be

noticed in each example that the gage pressure acts downward on the piston, tending to compress the gas, and that in the case of a vacuum the force is assumed to act upward; that is, the piston is acted upon by a pulling force instead of by pressure. The pressure of the atmosphere is acting with the gage pressure to produce the gross or absolute pressure. In the case of vacuum, the applied force is working against the atmosphere, or the pulling force plus the pressure of the contained gas just equals the pressure exerted by the atmosphere.


40 POUNDS PER SQUARE INCH ABSOLUTE PRESSURE
10 CUBIC FEET
40 DEGREES F
500 DEGREES F ABSOLUTE
20 POUNDS PER SQUARE INCH ABSOLUTE PRESSURE
20 CUBIC FEET
40 DEGREES F
500 DEGREES F ABSOLUTE
10 POUNDS PER SQUARE INCH ABSOLUTE PRESSURE
9-INCHES MERCURY VACUUM
40 CUBIC FEET
40 DEGREES F
500 DEGREES F ABSOLUTE
Pv = 40 X 10 = 20 X 20 = 10 X 40 = 400
BOYLE'S LAW

Boyle's or Mariotte's Law—The volume of any definite weight of gas at constant temperature decreases proportionately as the absolute pressure increases, and increases proportionately as the absolute pressure decreases.

Referring to the figures and examples it will be seen that, if the pressure on the gas is reduced from 40 pounds per square inch absolute to 20 pounds per square inch absolute, without any change of temperature, the volume will be doubled. Therefore, the absolute pressure multiplied by the volume is a constant. In the formula, $Pv = k$,

P = pressure in pounds per square inch absolute
v = volume in cubic feet
k = a constant depending upon the absolute temperature and total weight
(The weight of gas in each cylinder is the same.)

The following expressions, in which P_n and v_n are the new conditions, are based on this law.

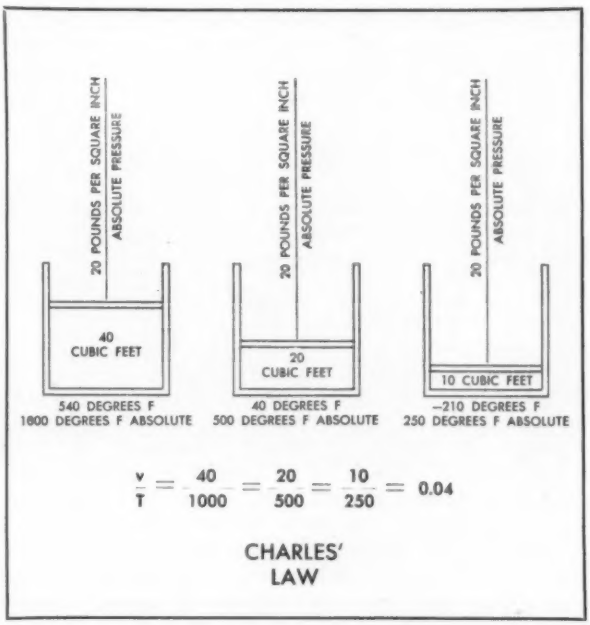
$$Pv = P_n v_n = k; \text{ then } v_n = \frac{Pv}{P_n}$$

Example: if the volume of a certain weight of gas is 1000 cu. ft. at 29.3 pounds per square inch absolute, what will the volume be at 14.65 pounds per square inch absolute?

$$\text{Answer: } v_n = \frac{Pv}{P_n} = \frac{29.3 \times 1000}{14.65} = 2000 \text{ cu. ft.}$$

Example: if the volume of a certain weight of gas is 10,000 cu.ft. at gage pressure of 132 pounds per square inch, and the atmospheric pressure is 14.5 pounds per square inch absolute, the volume expressed at 14.65 pounds per square inch is

$$v_n = \frac{Pv}{P_n} = \frac{(132 + 14.5)\ 10{,}000}{14.65} = 100{,}000 \text{ cu. ft.}$$


20 POUNDS PER SQUARE INCH ABSOLUTE PRESSURE
40 CUBIC FEET
540 DEGREES F
1800 DEGREES F ABSOLUTE
20 POUNDS PER SQUARE INCH ABSOLUTE PRESSURE
20 CUBIC FEET
40 DEGREES F
500 DEGREES F ABSOLUTE
20 POUNDS PER SQUARE INCH ABSOLUTE PRESSURE
10 CUBIC FEET
−210 DEGREES F
250 DEGREES F ABSOLUTE
v/T = 40/1000 = 20/500 = 10/250 = 0.04
CHARLES' LAW

Charles' Law—The volume of any definite weight of gas under constant pressure increases proportionately as the absolute temperature increases, and decreases proportionately as the absolute temperature decreases.

Referring to the figures and examples, it will be seen that if the gas is cooled from 1000 degrees F absolute to 500 degrees F absolute, without any change of pressure, the volume will be decreased one-half. Therefore, the volume divided by the absolute temperature is a constant. In the formula, $v/T = c$,

v = volume in cu. ft.
T = temperature in degrees F absolute.
c = a constant depending upon the absolute pressure and total weight.
(The weight of gas in each cylinder is the same.)

The following expressions, in which v_n and T_n are the new conditions, are based on this law.

$$\frac{v_n}{T_n} = \frac{v}{T} = c; \text{ then } v_n = \frac{vT_n}{T}$$

Example: if the volume of a certain weight of gas is 400 cu. ft. at 40 degrees F, what will the volume be at 60 degrees F? Answer:

$$v_n = \frac{vT_n}{T} = \frac{400 \times 520}{500} = 416 \text{ cu. ft.}$$

Example: if the volume of a certain weight of gas is 110,000 cu. ft. at a temperature of 90 degrees F, the volume of the same weight of gas expressed at a temperature of 60 degrees F, is

$$v_n = \frac{vT_n}{T} = \frac{110{,}000\ (460 + 60)}{(460 + 90)} = 104{,}000 \text{ cu.ft.}$$

Law of Perfect Gases—Let us assume that the theoretical volume of a pound of a certain ideal gas at one degree F absolute, under a pressure of one pound per square inch absolute, is Z cu. ft.; then, according to Charles' law, the volume increases as the absolute temperature increases, and the volume at an absolute temperature of T degrees, will be TZ cu. ft. at one pound per square inch absolute. But, according to Boyle's law, the volume decreases proportionately as the absolute pressure increases, so that if the pressure is P pounds absolute at an absolute temperature T, the volume per pound,

$$v = \frac{TZ}{P}; \text{ then } \frac{Pv}{T} = Z.$$

In the following formulas, P_n, v_n, and T_n represent the pressure, volume, and temperature of the same gas under conditions other than those represented by P, v, and T.

$$\frac{P_n v_n}{T_n} = \frac{Pv}{T} = Z; \text{ then } v_n = \frac{Pv\,T_n}{P_n\,T}$$

If the volume of a certain weight of gas is 20 cu. ft. at 10 pounds per square inch absolute at a temperature of 40 degrees F (absolute temperature, 500 degrees), the volume at 60 degrees F (absolute temperature, 520 degrees) under a pressure of 26 pounds per square inch absolute would be

$$V_n = \frac{Pv\,T_n}{P_n\,T} = \frac{20 \times 10 \times 520}{26 \times 500} = 8 \text{ cu. ft.}$$

Therefore, for a unit weight of gas, the product of the absolute pressure P, multiplied by the volume v, divided by the absolute temperature T, is a constant Z. The value of Z for air is 0.3701.

In the formulas, $\frac{Pv}{T} = Z$ and $\frac{Pv_a}{T} = 0.3701$

P = absolute pressure in pounds per square inch.
v_a = volume of one pound of air in cu. ft.
T = absolute temperature in degrees F.

The specific gravity of a fluid is the ratio of the weight of a cubic foot (under the same conditions of pressure and temperature) to the weight of a cubic foot of another fluid used as a standard or base. For gaseous fluids air is generally used as a base, and, consequently, its specific gravity is considered 1.00. For liquids, water is used as a base and its specific gravity is considered 1.00 at the point of maximum density.

Returning to the above formula in which v_a represents the volume in cubic feet occupied by a pound of air, it can be readily understood that, if the specific gravity G of a gas is less than unity, the volume of a pound of the gas is greater proportionately than the volume of a pound of air. If v represents the volume of a pound of the gas,

$$v = \frac{v_a}{G} \text{ or } v_a = vG, \text{ and } \frac{PvG}{T} = 0.3701; \text{ then } v = \frac{0.3701\,T}{PG}$$

The volume of a pound of gas, at 60 degrees F with a specific gravity of 0.60, under a pressure of 14.4 pounds per square inch absolute is,

$$v = \frac{0.3701\,T}{PG} = \frac{0.3701 \times 520}{14.4 \times 0.60} = 22.3 \text{ cu. ft.}$$

It is noticed that if the value of any term in this characteristic equation is changed, the value of one or more of the others must change. A clear understanding of this equation and its derivatives will eliminate most of the troubles now experienced in the application of the various factors used in gas engineering.

This chapter on Perfect Gases was prepared by John C. Diehl, Chairman of Board, American Meter Company, Erie, Penna.

FULL APPLIANCE SERVICE GIVES BROOKLYN BOROUGH CLEAN BILL OF HEALTH

DECLARING that the company is saving lives through its protective measures, Dr. John F. Mahoney, commissioner of the Department of Health, and Jerome Trichter, assistant commissioner, commended the work being done by the Brooklyn Borough Gas Company in providing full service for gas appliances as a vital part of its comprehensive safety program.

The Commissioner and Mr. Trichter made their joint statement following a tour of inspection of the company's operating properties at Coney Island. At the invitation of Walter M. Jeffords, Jr., president of the Brooklyn Borough Gas Company, the tour was made recently to show the procedure being carried out in converting from manufactured to natural gas and to demonstrate the safety program of the company. Conversion to natural gas was completed before Thanksgiving Day.

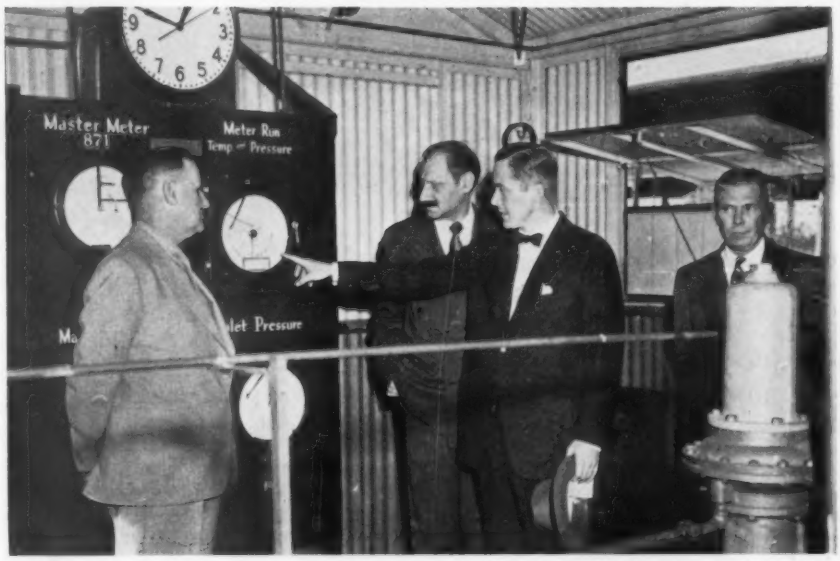
"We of the Department of Health commend the Brooklyn Borough Gas Company for its efforts in constantly improving its servicing and safety program. Its new two-way radio system is an example of the efforts being made to protect the consumers serviced by the company. Its safety record is excellent", the Commissioners stated at the close of the tour.

The company's safety program was detailed by Mr. Jeffords, as follows: the recent introduction of a two-way radio system with seven cars so equipped to patrol the district at all times; the maintenance of a customers service department with a staff of 48 servicemen and five supervisors, all of whom are company trained men fully qualified in all phases of gas appliance servicing and practically all of whom have A plus serviceman rating which means not less than seven years' experience regulating and servicing gas appliances and ability to pass the test for this high rating; 24 hour coverage by servicemen and supervisors and careful checking of installation of new gas refrigerators.

According to Mr. Jeffords, no fatalities attributable to faulty gas appliances have occurred in the area serviced by the company.

This area has a population of a half-million residents which makes it comparable in size to either Buffalo or Cincinnati.

As a community service, the company recently distributed to the owners of multiple dwellings and others using old-fashioned water-cooled gas refrigerators now outmoded, an excerpt from the Department of Health's circular warning against outmoded appliances.



Left to right: Dr. John F. Mahoney, health commissioner of New York City; Jerome Trichter, assistant health commissioner; Walter M. Jeffords, Jr., president of Brooklyn Borough Gas Company; Philip B. Bass, manager of customers' service, on safety-wise tour of inspection.

Two Committees Will Study Service Responsibility

A top flight examination of customer service responsibility will be undertaken by parallel committees just appointed by the American Gas Association and the Gas Appliance Manufacturers Association, as the result of action taken by the executive boards of both organizations. The committee for the gas utilities will be chairmanned by Howard B. Noyes, vice-president of Washington (D. C.) Gas Light Company, and Stanley H. Hobson, president of George D. Roper Corporation, will head the manufacturers' group.

From the utilities the committee is being organized largely among executives who are in charge of customer service for their various companies. Its purpose, as outlined in the letter of invitation that was sent to AGA members selected to serve, is to give consideration to the whole matter of customer service, defining the responsibilities of utilities, manufacturers, distributors and dealers. The committee will be authorized to make recommendations for further action by AGA, such as preparing a service code, or undertaking any other project that will improve the quality of customer service.

Manufacturer members will include top executives of appliance and equipment manufacturers, who will serve as a Sub-Committee on Gas Appliance Service Policy under the general aegis of GAMA's permanent Policy Committee.

Appointment of committees to resolve the troublesome problem of service responsibility is the result of widespread industry concern over the breakdown of public relations in parts of New York City.

October Gas Heating Shipments

Credit restrictions and reduced home construction are reflected in shipments by manufacturers of gas-fired central heating equipment for October. There were 72,600 units shipped in October, bringing the total for the first ten months of this year to 516,100, according to Edward R. Martin, director of marketing and statistics of the Gas Appliance Manufacturers Association. These figures compared with 97,600 units shipped in October 1950, and a ten months total of 892,500.

The October shipments comprised 44,200 gas-fired furnaces, 6,800 gas-fired boilers, and 21,600 conversion burners. The same breakdown for the ten months is: furnaces, 329,600; boilers, 51,500 and conversion burners, 135,000.

Measurement and

6 ways to measure better

NO. 00 DOMESTIC METER

The Rockwell No. 00 is attractively cased in a housing of pressure cast aluminum alloy; rust-proof, corrosion-proof with a high fracture resistance for safety. Compact dimensions save shipping space, permit installation in close quarters. Has a removable and interchangeable measuring unit that cuts maintenance costs. Made with steel spud top connections for natural gas service or female threaded side or top connections for LP-gas. Capacity 150 cfh*.

NO. 0, 1, AND 2 DOMESTIC METERS

These meters are used to measure natural, manufactured or LP-gas; have wide application for house heating installations, commercial and small industrial services. Standardized construction in all sizes permits parts and group assemblies to be readily interchanged. The basic design follows the time-proven Rockwell pattern with all operating parts attached to a removable valve plate to simplify shop maintenance. No. 0 capacity 175 cfh*, No. 1 capacity 275 cfh*, No. 2 capacity 415 cfh*.

5LT AND 10LT TIN METERS

Many design advances and improvements are incorporated in these meters. Outer cases are coated with zinc chromate (optional) to protect against rusting. Heavier flanges guard against leaks. Extra deep cases prevent diaphragm contact. Thicker sections are provided in flag wires and flags. A heavy tangent, brass links, and chrome plated crank result in better performance, longer life. Large ports and channels provide greater capacities. Four 5 lt models rated at 150, 200, 250 and 300 cfh*, three 10 lt models rated at 300, 425 and 500 cfh*.

NO. 2½, 3 AND 4 CAST IRON METERS

These strong, precisely accurate positive meters are measurement engineered for long service life. They are more economical, too. If desired the entire working mechanism can be replaced as a unit with a shop calibrated duplicate assembly while the meter body stays in the line. These meters can be fitted with either Combined Record Gauges or Emcorectors to convert high pressure measurement to corrected volumes at any given base pressure. No. 2½ capacity 1800 cfh**, No. 3 capacity 2500 cfh**, No. 4 capacity 5000 cfh**.

NO. 4½ AND 5 PRESSED STEEL METERS

While giants in capacity, Rockwell No. 4½ and 5 meters are comparatively light in weight; extremely compact in the actual floor space required for setting. The steel frame is welded to a cast iron valve plate to provide rigidity. Pressed steel side plates and cover furnish great impact resistance. These meters can be furnished with either Combined Record Gauges or the Emcorector to correct gas measured at high pressures to a constant low base pressure. No. 4½ capacity 8000 cfh**, No. 5 capacity 10,000 cfh**.

ORIFICE METER

Measures accurately over a wide range of pressures and volumes by the orifice plate differential principle. Features include forged steel mercury chamber and differential housing, stainless steel internal parts, entirely independent static and differential movements, exceptionally large float, leak proof stuffing box, positive inking pens and interchangeable high side chambers. Models available—20", 50", 100", 200", 300" and 400" differential.

** These meter ratings are given for 0.60 sp. gr. gas at ½ in. pressure absorption.*
*** These meter ratings are given for 0.60 sp. gr. gas at 2 in. pressure absorption.*

ROCKWELL meters and regulators

EMCO

Control Digest

KEEP EVERYTHING UNDER CONTROL

BALANCED VALVE REGULATORS—Rockwell high and low pressure balanced valve regulators are used on lines carrying natural, manufactured or LP-gas and are made in sizes from 2 in. to 12 in. Various types of controls can be applied as shown in the accompanying illustrations. The design of these regulators is such that they can be inspected, serviced, repaired and capacities can even be varied up or down without removing from the line. An exclusive feature is the valve chamber (inlet bowl assembly) which may be removed and replaced through a hand hole opening in the body.

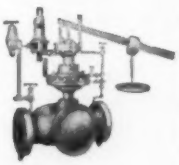
HIGH PRESSURE
Lever and Weight Type

HIGH PRESSURE
Pilot Loaded

LOW PRESSURE
Either outside or inside weights

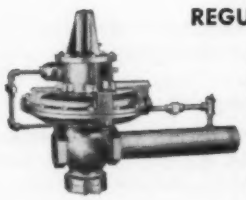
HIGH PRESSURE
Spring Loaded

HIGH PRESSURE
Instrument Control



HIGH PRESSURE
Pilot Loaded with Auxiliary Lever and Weight Control

"1001" REGULATORS

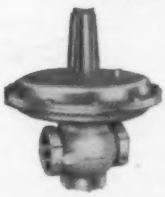


A general purpose regulator with the sensitivity and response of a pilot loaded diaphragm. Will reduce inlet pressures of 200 psi or less to an outlet pressure range of 2 oz. to 60 psi, depending on spring selected and setting. Size 2 in. only.

APPLIANCE REGULATORS

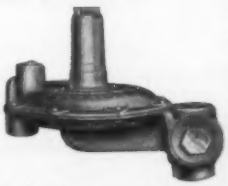
Provide highest burner efficiency, prevent pilots from being extinguished on all types of gas burning appliances. Sizes ⅛ in. through 1¼-in. have pressure cast aluminum alloy cases. Larger sizes up to 3 in. are cast iron.

CRAWFORD REGULATORS



Control outlet pressures from 1 psi to atmospheric pressure or less with inlet pressures ranging up to 5 psi. Used for gas engine carburetor control, industrial furnaces, large appliances. Ideally suited to special applications. Sizes ¾ in. to 6 in.

SERVICE REGULATORS



Reduce distribution pressures in psi or the higher ranges of ounces to controlled utilization pressures in inches of water. The exclusive ejector principle in the valve chamber provides automatic outlet boost to compensate for increased demands. Sizes ¾, 1, 1¼, 1½ and 2 in.

ROCKWELL MANUFACTURING COMPANY

PITTSBURGH 8, PA.

Atlanta • Boston • Chicago • Columbus • Houston • Kansas City • Los Angeles

ROCKWELL

Product Data

BUILT WELL BY ROCKWELL

You can rely on Rockwell meters and regulators for lasting precision and a longer useful life. The sturdy mechanisms are built from carefully engineered designs with the finest materials and workmanship. Over the years you save money through the repair ease and economy of Rockwell maintenance procedures.

THESE CAPSULE DESCRIPTIONS

. . . of Rockwell products serve to highlight the scope of the complete line. Here at one reliable source, you will find gas measurement and control equipment to fit every possible volume or pressure requirement. Rockwell meters and regulators go together like hand in glove. You can make engineered pairings from the most complete line in the industry. Our experienced field representatives and factory staff will gladly assist you in the specification of the proper type and size to best serve your needs.

IS 100% NATURAL GAS THE ANSWER?

by E. G. Boyer

Philadelphia Electric Company

Part 2

Part 1 of this AGA convention paper appeared in the November issue.

1. MATERIALS AVAILABLE FOR PRODUCTION

IN the Philadelphia Electric Co., the materials available for the production of gas are shown in table 5.

a. *The coke oven gas* is available from two sources: (1) One is from our own coke oven plant at Chester. The daily production of about 4,500 Mcf is sent to the Tilghman Street plant (about one mile away) where it is mixed with the production from other sources. (2) The other source is the Alan Wood steel plant at Swedeland, Pa. from which we purchase by contract a maximum of 17,500 Mcf per day. This is sent to the West Conshohocken plant where it is purified and handled.

b. *The natural gas* is obtained by contract from two supplying companies for 57,000 Mcf per day. It is used in all of our production plants.

c. *Refinery oil gas* is purchased by contract from the Sinclair Refining Company. The maximum contract quantity is 120,000 therms per day, but more can be obtained, by verbal request, if it is available. The minimum quantity which we must take, or pay a penalty charge for, is a daily average of 24,000 therms per day during each calendar month. This gas is available at only the two Chester plants: Tilghman Street, and the coke ovens.

d. *The gas oil* is stored at the Tilghman Street plant in Chester, at the West Conshohocken plant, and at Oreland. It is used for carburetted water gas at Oreland and West Conshohocken, and for carburetted water gas and the production of high Btu oil gas at our Tilghman Street plant.

e. *Propane* is stored at both the Tilghman Street plant and at West Conshohocken. At West Conshohocken it is used either for cold enriching or for feed stock for the Girdler catalytic reformed unit. At Tilghman Street it is used principally for cold enriching.

f. *The coke* comes from the production of the coke oven gas at our coke oven plant. It is sent to the three other plants where it can be used for the production of blue gas, carburetted water gas, producer gas, or thermally reformed refinery oil gas or natural gas.

2. GASES THAT CAN BE PRODUCED

The gases that can be produced in the Philadelphia Electric Company plants from the raw materials are shown in table 6.

These gases can be produced on equipment in service now at our various plants; not all at the same plant it is true, but somewhere in our system the gases as mentioned in this table can be produced. They can be mixed with the coke oven gas, and/or the cold enriching gases which are natural gas, refinery oil gas and liquefied petroleum gas. These mixtures, then, are the ones that will be discussed to show how the Philadelphia Electric Company decided upon a new base gas of 800 Btu's and 0.58 specific gravity.

3. ADAPTABILITY OF GASES STUDIED BY TRIANGULAR CHARTS

a. General

The first step in our planning was to develop a series of three-component charts to illustrate what to expect from the mixtures of our available gases. When the base data were plotted on rectangular coordinate paper, the charts proved to be triangular in shape, with the point representing 100 per cent of each component gas as a corner of the triangle.

It will be well, at this point, to discuss a simple basic triangular chart.

b. Basic triangular chart

Figure 1 represents a simple rectangular chart. On the ordinate are plotted values of specific gravity. On the base

TABLE 5

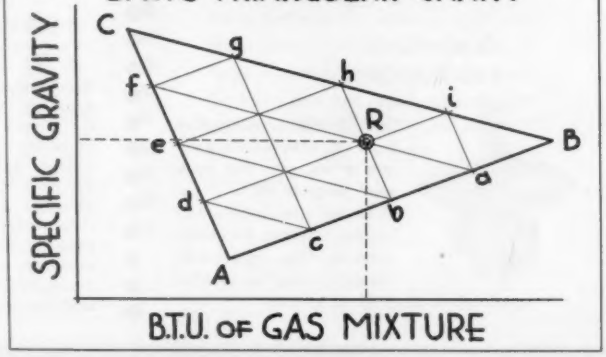
Material	Btu	Specific Gravity	H_2 Content
a. Coke Oven Gas, Cu. Ft.	530	0.480	56%
b. Natural Gas, Cu. Ft.	1040	0.620	—
c. Refinery Oil Gas, Cu. Ft.	1665	1.068	3%
d. Gas Oil, Gallons	136000	—	—
e. Propane (LP Gas) Cu. Ft.	2600	1.590	—
f. Coke, Pounds	12500	—	—
g. Air	—	—	—

TABLE 6

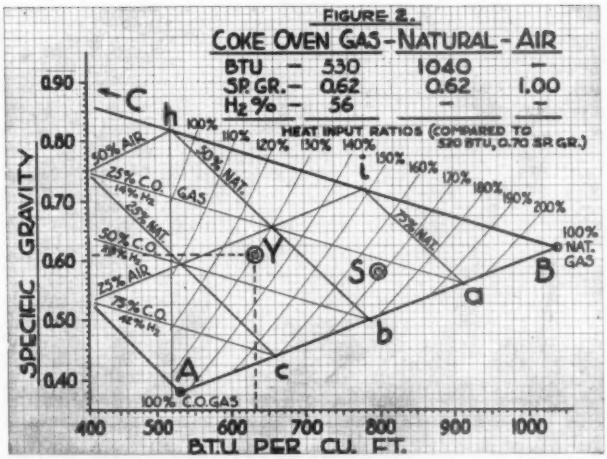
Gas Produced	Btu	Specific Gravity	H_2 Content
a. Blue Gas	280	0.550	48%
b. Carburetted Water Gas	520	0.640	38
c. Catalytic Reformed Natural Gas	348	0.340	68
d. Catalytic Reformed Propane (without air)	363	0.390	64
e. Catalytic Reformed Propane (with air)	292	0.570	44
f. Thermal Reformed Natural Gas	596	0.505	36
g. Thermal Reformed Oil Gas	556	0.498	48
h. High Btu Oil Gas	1012	0.830	16
i. Producer Gas	134	0.905	12

FIGURE 1

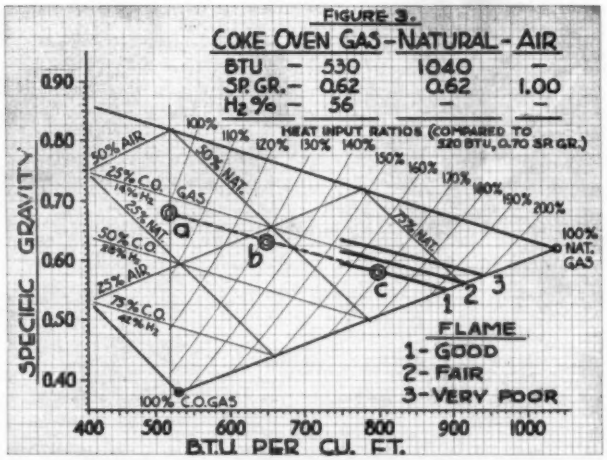
BASIC TRIANGULAR CHART



Basic triangular chart for gas mixtures.



Principles of Triangular Chart Applied to Mixture of Coke Oven Gas, Natural Gas, and Air.



Appliance Limit—Performance Lines of Btu and Specific Gravity without Drilling Ports.

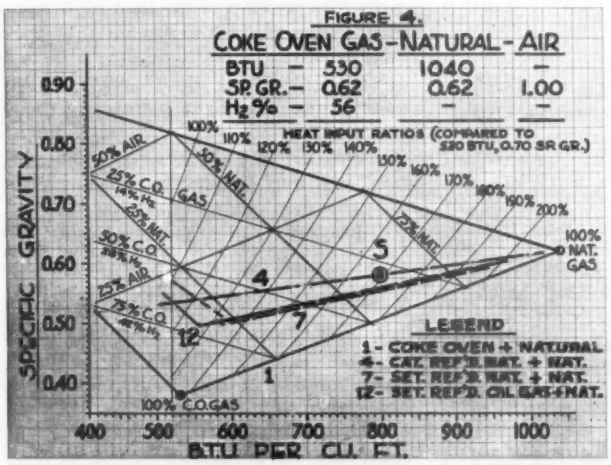


FIGURE 4.
COKE OVEN GAS-NATURAL-AIR
BTU — 530 1040 —
SP. GR.— 0.62 0.62 1.00
H₂ % — 56 — —
HEAT INPUT RATIOS (COMPARED TO 520 BTU, 0.70 SP. GR.)
SPECIFIC GRAVITY
BTU. PER CU. FT.
100% C.O. GAS
100% NAT. GAS
50% AIR
50% NAT.
25% C.O. 14% H₂
25% NAT.
50% C.O. 28% H₂
25% AIR
75% C.O. 42% H₂
75% NAT.
LEGEND
1 - COKE OVEN + NATURAL
4 - CAT. REF'D. NAT. + NAT.
7 - SET. REF'D. NAT. + NAT.
12 - SET. REF'D. OIL GAS + NAT.

Composite Comparison of Four Base Gas Mixtures at 800 Btu and 0.58 Specific Gravity.

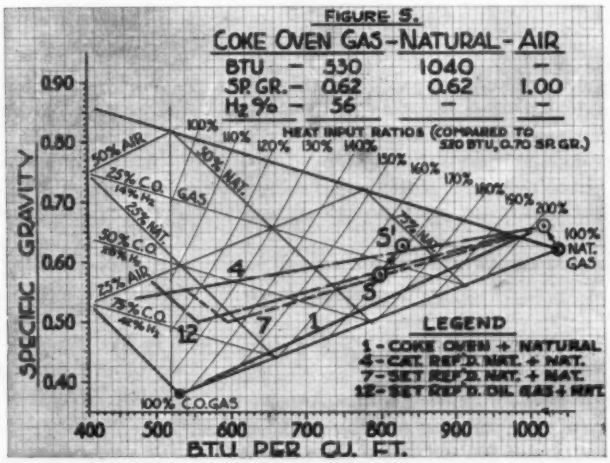


FIGURE 5.
COKE OVEN GAS-NATURAL-AIR
BTU — 530 1040 —
SP. GR.— 0.62 0.62 1.00
H₂ % — 56 — —
HEAT INPUT RATIOS (COMPARED TO 520 BTU, 0.70 SP. GR.)
SPECIFIC GRAVITY
BTU. PER CU. FT.
100% C.O. GAS
100% NAT. GAS
50% AIR
50% NAT.
25% C.O. 14% H₂
25% NAT.
50% C.O. 28% H₂
25% AIR
75% C.O. 42% H₂
75% NAT.
LEGEND
1 - COKE OVEN + NATURAL
4 - CAT. REF'D. NAT. + NAT.
7 - SET. REF'D. NAT. + NAT.
12 - SET. REF'D. OIL GAS + NAT.

Composite Comparison of Four Base Gas Mixtures with Changed Characteristics of Natural Gas.

line are plotted Btu values of the gas mixture.

Let A, B, and C represent three gases that are to be mixed. The characteristics of 100 per cent of each component gas are plotted respectively at A, B, and C on the diagram.

Points along the line AB represent mixtures of A and B, from 100 per cent of A and 0 per cent of B, to 0 per cent of A and 100 per cent of B. The percentages of each gas are proportional to the distance from the vertex point of the other gas. For example, point (a) is ¼ the distance from B to A; therefore, it represents 25/100 x 100 = 25 per cent of gas A, and 75/100 x 100 = 75 per cent of gas B; and the projection of point (a) to the two axes will give the Btu and specific gravity of that point.

In like manner, line AC represents mixtures of gases A and C; and points d, e, and f represent proportional mixtures whose characteristics may be obtained by projection to the coordinate axes.

Likewise, line BC represents any mixture of gases B and C, and points g, h, and i represent proportional mixtures whose characteristics may be obtained by projection to the coordinate axes.

For aids in interpolating the percentages of the various component gases in any mixture, lines are drawn at intervals of 25 per cent along each two-component-gas line. These "percentage lines" refer to the gas represented by the angle opposite them; as, lines cd, be and af are opposite angle A, and represent, respectively, 75 per cent, 50 per cent, and 25 per cent of gas A in the mixture. In like manner, "percentage lines" ai, bh, and cg are opposite angle B and represent, respectively, 75 per cent, 50 per cent, and 25 per cent of gas B in the gas mixture.

The space enclosed within the triangle ABC represents mixtures of the three component gases. For any point, the percentage of each component gas may be interpolated, and by projection to the axes the Btu content and specific gravity of the point may be determined. For example, let R in Figure 1 represent such a point. By interpolation, it is found that it represents 25 per cent of A, 50 per cent of B, and 25 per cent of C.

The values of the Btu and specific gravity for point R are found by projecting it vertically and horizontally, respectively, to the axes, as illustrated by the dashed lines.

c. Adaptation of the triangular chart to actual gas mixtures

The principles just outlined in the basic triangular chart may now be applied to actual gas mixtures. In Figure 2 is a representative example of this adaptation to a mixture of coke oven gas, natural gas and air. The letters shown on this Figure 2 are the same as those on the basic triangular chart for ease of orientation.

You will notice that point C, representing 100 per cent air, is not shown on the chart, being omitted to permit a large scale to be applied to the Btu values, above, say 400 Btu. This same principle is applied to all the charts in this paper. That is, in general, the diagrams cover only the range of values of benefit to the study which the Philadelphia Electric Company made. For this reason a vertical line is shown on these charts at 520 Btu's which was the standard heat con-

TABLE 7
GAS MIXTURES STUDIED BY CHARTS

Chart No.	Gas Mixture
1	Coke Oven Gas + Natural Gas + Air
2	Coke Oven Gas + Propane + Air
3	Carburetted Water Gas + Propane + Air
4	Catalytic Reformed Natural Gas + Natural Gas + Air
5	Catalytic Reformed Natural Gas + Propane + Air
6	Catalytic Reformed Propane (Steam and Air used for Reforming) + Propane + Air
7	Set Reformed Natural Gas + Natural Gas + Air
8	Set Reformed Natural Gas + Propane + Air
9	Set Reformed Natural Gas + High Btu Oil Gas + Air
10	Blue Gas + Natural Gas + Air
11	Blue Gas + Propane + Air
12	Reformed Oil Gas + Natural Gas + Air
13	Reformed Oil Gas + Oil Gas + Air
14	Reformed Oil Gas + Propane + Air
15	Reformed Oil Gas + High Btu Oil Gas + Ai
16	Coke Oven Gas + Natural Gas + Producer Gas
17	Coke Oven Gas + Propane + Producer Gas
18	Catalytic Reformed Natural + Natural + Producer Gas
19	Catalytic Reformed Natural + Propane + Producer Gas
20	Catalytic Reformed Propane* + Propane + Air
21	Catalytic Reformed Propane* + Propane + Producer
22	Catalytic Reformed Propane* + Natural + Producer
23	Catalytic Reformed Propane* + Natural + Air
24	Coke Oven Gas + Refinery Oil Gas + Air + Natural
25	Carburetted Water Gas + Refinery Oil Gas + Air
26	Carburetted Water Gas + Natural Gas + Air

*No air used for reforming.

TABLE 8
CHARACTERISTICS OF FOUR PROPOSED BASE GASES AS INTERPOLATED FROM FIGURE 4

Chart No.[1]	Component Gases in Mixture: Gas Produced at Plants — Percent Coke Oven Gas	Thermally (Set) Reformed Natural Gas Percent	Percent Thermally (Set) Reformed Oil Gas	Catalytic Reformed Natural Gas Percent	Enriched Natural Gas Percent	Percent Air	Percent Hydrogen (H_2)	Mcf of Sendouts per 1000 Mcf of Gas Produced at Plants
1	30	—	—	—	62	8	16	3,330
4	—	—	—	24	59	7	16	4,170
7	—	47	—	—	50	3	17	2,130
12	—	—	43	—	54	3	21	2,325

[1]Refer to Table 7.

tent of our sendout gas at the time of the study. This line is drawn on each chart, and is in general the value below which no data are necessary for study.

Each of the percentage lines is labeled clearly as to the gas it represents.

d. Additional information

1. CHARACTERISTICS OF COMPONENT GASES

(a) General. At the head of Figure 2 it will be noted that there are listed the gases in the mixture, and the characteristics of 100 per cent of each gas. These include the Btu per cubic foot, the specific gravity, and the hydrogen content. The various lines on the chart enable one to interpolate the percentage of each component gas in the complete mixture.

(b) Hydrogen content. To facilitate the approximation of the hydrogen in the mixture, the percentage of the hydrogen (H_2) has been shown on the "percentage lines" of each component gas which contains hydrogen. For example, on Figure 2, 100 per cent coke oven gas is shown as containing 56 per cent hydrogen (H_2). Therefore, on the 75 per cent coke oven line, 42 per cent H_2 is shown; on the "50 per cent coke oven gas line" 28 per cent H_2 is shown; and so on. The H_2 percentage at the point representing any mixture of the three component gases is determined by taking the inversely proportionate distance of the point between the two adjacent percentage lines.

(c) Proportionate lines. Under the discussion of the basic triangular chart it was mentioned that the various lines are shown to give the percentage of the various component gases in the mixture. Now for any mixture the characteristics of the point may be interpolated. For example, Figure 2 shows a point Y. Interpolation of point Y gives the following characteristics:

Per cent coke oven gas =	37.5%
Per cent natural gas =	41.7%
Per cent air =	20.8%
Btu per cubic foot =	632
Specific gravity =	0.609
Per cent hydrogen =	21.0%

These values may be checked by applying them to the 100 per cent characteristics of the component gases as shown at the head of the chart.

In like manner, the characteristics of any other selected mixture may be interpolated.

2. HEAT INPUT AND MAIN CAPACITY

For any gas, the "heat input" to an appliance burner is a function of the Btu content (H) and (other things being equal) the square root of the specific gravity (G), and is expressed as

$$\text{Heat Input Factor} = \frac{H}{\sqrt{G}}$$

The "heat inputs" of two gases may be compared by the ratio of their "heat input factors." This is done by dividing that for the "base or standard gas" into that for the "substitute gas."

In this study the "base gas" was considered to be at 520 Btu and 0.70 specific gravity, representing average adjustment of the appliances in the high gravity area of the Philadelphia Electric Company before the conversion. Its "heat input factor," F, is then

$$F = \frac{520}{\sqrt{0.70}} = \frac{520}{0.837} = 621.27$$

For the new base gas at 800 Btu and 0.58 specific gravity the "heat input factor," f, is

$$f = \frac{800}{\sqrt{0.580}} = \frac{800}{.762} = 1049.87$$

The ratio $\frac{f}{F} = \frac{1049.87}{621.27} = 1.69$; that is, the new base gas gives 1.69 times (169 per cent of) the heat input of the 520 Btu gas.

In like manner, comparative ratios can be determined for any mixture. Shown on Figure 2 are "lines of *constant* heat input"; from 100 per cent to 200 per cent. That is, for example, every point on the curve marked 150 per cent gives 150 per cent of the heat input supplied by the gas of 520 Btu and 0.70 specific gravity.

The same "heat input" curves serve as an indication of the increase in theoretical "thermal capacity of the gas transmission and distribution main system" that may be expected with any gas mixture when compared to that with the 520 Btu gas at 0.700 specific gravity.

e. Gas production capacity

1. The charts provide information as to the amount of "sendout gas" that can be obtained from the production-component-gas in any mixture.

(a) For example, using Figure 2, assume that it is desired to know how much gas can be sent out with a mixture represented by point Y.

The production-component gas is coke oven gas. As interpolated previously, point Y contains 37.5 per cent of coke oven gas. Then, with the full contract quantity of purchased coke oven gas of 17,500 Mcf per day, the amount of sendout gas possible will be

$$\text{Sendout} = \frac{17{,}500}{0.375} = 46{,}670 \text{ Mcf; and}$$

the components will be:

Coke oven gas	= 37.5%	= 17,500 Mcf
Natural gas	= 41.7%	= 19,460 Mcf
Air	= 20.8%	= 9,710 Mcf
		46,670 Mcf
H_2 percentage	=	21.0%

(b) As a second example, find the sendout that can be obtained with a gas at point S, Figure 2, of 800 Btu and 0.58 specific gravity, with 17,500 Mcf of coke oven gas.

By interpolation, point S has the following composition:

Coke oven gas	=	30.0%
Natural gas	=	62.0%
Air	=	8.0%
Total	=	100%

Then, the full amount of sendout gas that can be made will be:

$$\text{Sendout} = \frac{17{,}500}{0.300} = 58{,}330 \text{ Mcf and}$$

the components will be:

Coke oven gas	= 17,500 Mcf
Natural gas	= 36,165 Mcf
Air	= 4,665 Mcf
Total	= 58,330 Mcf
H_2 percentage	= 16.0%

(c) This "production capacity" function of the charts is of special importance and value when applied to those gases which can be produced by our own production equipment at Chester (coke ovens, gas reforming sets, etc.) and at West Conshohocken (producers, blue gas sets, the contemplated catalytic cracking plant, etc.).

Knowing the capacity of the equipment for making the production-component gas, and the quantity of enriching gases available, the total plant sendout can be determined by combining the information from several charts, as the case may require.

f. Other charts

Figure 2 has been used as an example for the explanations. Table 7 lists the other charts, by number and components, prepared for this study. The principles which have been outlined apply to these other charts in a similar manner.

To facilitate their use during group discussions, the charts were enlarged to

TABLE 9

SUBSTITUTE GAS MIXTURES 100 PERCENT INTERCHANGEABLE WITH THE FOUR BASE GAS MIXTURES @ 100 PERCENT HEAT INPUT

Chart No.[1]	Gas Mixture: Component Gas	Percent	Btu	Specific Gravity	Hydrogen Percent	Appliance Burner Performance
10	Blue Gas	29.0				
	Natural Gas	71.0				
	Air	0				
	Total	100.0	812	0.600	14.2	Satisfactory
16	Coke Oven Gas	27.3				
	Natural Gas	62.3				
	Producer Gas	10.4				
	Total	100.0	800	0.580	16.6	Satisfactory
18	Catalytic Ref'd Nat. Gas	30.0				
	Natural Gas	70.0				
	Producer Gas	0				
	Total	100.0	800	0.580	16.7	Satisfactory
22	Catalytic Ref'd Propane	26.1				
	Natural Gas	69.8				
	Producer Gas	4.1				
	Total	100.0	800	0.580	18.3	Satisfactory
23	Catalytic Ref'd Propane	27.1				
	Natural Gas	70.3				
	Air	2.6				
	Total	100.0	800	0.580	19.1	Satisfactory
26	Carburetted Water Gas	38.6				
	Natural Gas	61.4				
	Total	100.0	816	0.610	14.9	Satisfactory

[1]Refer to Table 7.

TABLE 10

BORDERLINE SUBSTITUTE GAS MIXTURES 100 PERCENT INTERCHANGEABLE WITH THE FOUR BASE GAS MIXTURES @ 100 PERCENT HEAT INPUT

Chart No.[1]	Gas Mixture: Component Gas	Percent	Btu	Specific Gravity	Hydrogen Percent	Appliance Burner Performance
2	Coke Oven Gas	79.7				
	Propane	15.1				
	Air	5.2				
	Total	100.0	800	0.580	45.0	Satisfactory, but on verge of yellow tip formation
8	Thermal Ref'd Natural Gas	81.3				
	Propane	16.2				
	Air	2.5				
	Total	100.0	869	0.690	28.6	Satisfactory, but on verge of yellow tip formation
13	Thermal Ref'd Refinery Oil Gas	54.0				
	Refinery Oil Gas	43.0				
	Air	3.0				
	Total	100.0	880	0.696	26.7	Satisfactory, but on verge of yellow tip formation
15	Thermal Ref'd Refinery Oil Gas	41.0				
	High Btu Oil Gas	56.8				
	Air	2.2				
	Total	100.0	839	0.638	29.8	Satisfactory, but on verge of yellow tip formation
17	Coke Oven Gas	78.6				
	Propane	15.0				
	Producer Gas	6.4				
	Total	100.0	800	0.580	45.1	Satisfactory, but on verge of yellow tip formation
24	Coke Oven Gas	62.7				
	Refinery Oil Gas	30.6				
	Air	6.7				
	Total	100.0	800	0.580	38.4	Satisfactory, but on verge of yellow tip formation
25	Carburetted Water Gas	55.0				
	Refinery Oil Gas	45.0				
	Air	0				
	Total	100.0	927	0.778	26.6	Satisfactory, but on verge of yellow tip formation

[1]Refer to Table 7.

TABLE 11

SUPPLEMENTAL GAS MIXTURES REQUIRING BASE GAS ADDITION TO ELIMINATE YELLOW TIP FLAMES.
100 PERCENT HEAT INPUT COMPARED TO 800 BTU AND 0.58 SP. GRAVITY

Chart No.[1]	Gas Mixture: Component Gases	Percent	Btu	Specific Gravity	Hydrogen Percent	Percent Base Gas Required with Supplemental Gas to Eliminate Yellow Tips
3	Carburetted Water Gas	72.1				
	Propane	25.9				
	Air	2.0				
	Total	100.0	975	0.862	27.9	50.0
5	Catalytic Ref'd Nat. Gas	69.1				
	Propane	30.9				
	Air	0				
	Total	100.0	952	0.820	38.5	50.0
9	Thermal Ref'd Nat. Gas	45.0				
	High Btu Oil Gas	53.0				
	Air	2.0				
	Total	100.0	842	0.639	25.6	10.0
11	Blue Gas	68.5				
	Propane	31.5				
	Air	0				
	Total	100.0	980	0.870	33.6	45.0
14	Thermal Ref'd Refinery Oil Gas	80.0				
	Propane	18.0				
	Air	2.0				
	Total	100.0	867	0.708	37.6	30.0
19	Catalytic Ref'd Nat. Gas	69.1				
	Propane	30.9				
	Producer Gas	0				
	Total	100.0	952	0.820	38.5	50.0
20	Catalytic Ref'd Propane	72.5				
	Propane	27.5				
	Air	0				
	Total	100.0	900	0.730	51.0	50.0
21	Catalytic Ref'd Propane	72.5				
	Propane	27.5				
	Producer Gas	0				
	Total	100.0	900	0.730	51.0	50.0

[1]Refer to Table 7.

TABLE 12

SUPPLEMENTAL GAS MIXTURES REQUIRING BASE GAS ADDITIONS TO CLEAR YELLOW TIPPED FLAMES TO GIVE SAME LIFTING LIMIT AS THAT FOR THE BASE GAS ALONE

Chart No.[1]	Gas Mixture: Component Gases	Percent	Btu	Specific Gravity	Percent Hydrogen	Percent Base Gas Required with Supplemental Gas to Eliminate Yellow Tips
2	Coke Oven Gas	35.0				
	Propane	35.8				
	Air	31.2				
	Total	100.0	1030	0.947	19.7	50.0
5	Catalytic Ref'd Natural Gas	48.4				
	Propane	36.0				
	Air	15.6				
	Total	100.0	1025	0.950	27.0	50.0
11	Blue Gas	45.2				
	Propane	36.9				
	Air	17.9				
	Total	100.0	1050	1.000	22.1	60.0
17	Coke Oven Gas	31.3				
	Propane	32.7				
	Air	36.0				
	Total	100.0	1030	0.947	21.9	55.0
19	Catalytic Ref'd Natural Gas	43.8				
	Propane	35.4				
	Producer Gas	20.8				
	Total	100.0	1025	0.950	26.9	55.0
20	Catalytic Ref'd Propane	43.0				
	Propane	36.2				
	Air	20.8				
	Total	100.0	1030	0.950	30.3	55.0
21	Catalytic Ref'd Propane	37.9				
	Propane	35.4				
	Producer Gas	26.7				
	Total	100.0	1030	0.950	29.8	60.0

[1]Refer to Table 7.

40" x 50" and mounted. When needed, they are hung on easels and are usable in a few moments.

For desk use and study, letter size lithographs were prepared bound in sets, and distributed to the personnel engaged in the study. They proved to be so useful and authoritative that they are being used constantly for day-to-day operation and the solution of various problems that arise.

B. Study of limiting characteristics of gas before appliance ports must be enlarged

1. GENERAL

Our next problem in selecting a new base gas was to determine the maximum combinations of Btu and specific gravities that could be utilized with complete satisfaction by the customers' appliances without the necessity for enlarging burner ports. It was known that the expense of converting the territory would vary directly as the amount of drilling required. Experience of other companies was that for natural gas, 100 per cent drilling was required. We wanted to go as high in Btu as possible, with accompanying specific gravity, to meet our situation, with as little drilling as possible.

2. TESTS

a. Some appliances, known to have critical adjustments, were set up in the laboratory. Various gas mixtures were prepared with coke oven gas, natural gas, and air, varying the combinations of Btu and specific gravity until limit mixtures were obtained.

b. The first test was to determine mixtures that were *entirely satisfactory*. The results are plotted in Figure 3 by line 1. It will be noticed that line 1 passes through 800 Btu and 0.58 specific gravity (point C).

c. The second test was to determine mixtures that were *passable*, or satisfactory for peak or short periods. These limits are shown by line 2.

d. The third test was to determine the absolute limit above which performance was *unsatisfactory and objectionable*. This limit is shown by line 3.

3. CONCLUSIONS

The tests showed that any value along or below line 1 would be satisfactory without extensive port drilling. Inasmuch as the line denotes the limit, it was decided to consider values along line 1.

In the study of the characteristics of line 1, it was noticed that it was practically parallel to the line for "per cent coke oven gas" in the mixture. This also meant that it was practically parallel to the "per cent of hydrogen" line; and this was a very important observation. An interpolation of the hydrogen content showed it to be about 16 per cent, which checked the actual analysis of the test gas. This reminded us of our operation on 520 Btu; that in about 60 per cent of our territory our standard base gas was 520 Btu and 0.68 specific gravity (point "a" on Figure 3), *with a hydrogen content of about 16 per cent*. Further investigation showed that the Philadelphia Gas Works Company changed its standard recently to 650 Btu and 0.63 specific gravity (point "b" on Figure 3). When a line was drawn from point "a" to line 1, it was found to pass through the Philadelphia Gas Works point, and *was parallel to the per cent hydrogen line over its entire length.*

From this we concluded that along the whole range of values the *limiting* characteristic was the percentage of H_2 in the gas, and that if the H_2 were kept to not less than 16 per cent, no extensive port drilling would be required, regardless of the Btu value selected.

Another conclusion was that regardless of the value selected along line 1, the percentage of coke oven gas remained the same in all mixtures. That is, as the Btu's were increased, the only change made was: the per cent inerts was decreased and the per cent natural gas was increased; there was no change at all in the per cent of coke oven gas. This is a most important point: no matter what mixture is produced, the volumes of the sendout gas are the same. That is, for example: the 16 per cent H_2 line is for 30 per cent coke oven gas, so for every 1,000 Mcf of coke oven gas, the sendout quantity will be 3,330 Mcf for 520 Btu and 0.68 specific gravity gas, or for 850 Btu and 0.55 specific gravity gas. This one conclusion simplifies operations considerably by eliminating all concern about capacity; it is established for all values.

Therefore, the selection of the values of the new standard will be referred to this line 1, between 750 Btu and 850 Btu.

C. Base Gas Mixtures

1. SELECTION OF BASE GAS MIXTURES

For gases to be selected as the base gases under the new standard the raw materials for production must be (a) available, (b) flexible in quantity to accommodate variations in demands, (c) adaptable to installed and proposed production processes. The gases produced from them (d) must give good performance in customers' appliances, and (e) must be perfectly interchangeable one with another.

A comparison of these requirements with the raw materials that are available to us show that the ones that must be considered are natural gas, refinery oil gas and coke oven gas; the base gases should include various combinations of these three. Therefore, the proposed base gases are as follows:

a. Coke oven gas, natural gas and air.
b. Thermally reformed (on sets) oil gas, natural gas and air.
c. Thermally reformed (on sets) natural gas, natural gas and air.
d. Catalytically reformed natural gas, natural gas and air.

This latter is included in our study to show how it will fit into our picture after our coke oven gas contract expires at the end of 1954.

2. COMPARISON OF BASE GAS CHARACTERISTICS

a. Production possibilities

For the purpose of illustrating the use of the charts, consider the point for the gas at 800 Btu and 0.58 specific gravity.

The first question is: Can such a gas be made by the proposed base gas mixtures? On Figure 4 point S represents the 800 Btu and 0.58 specific gravity gas. At the bottom of this chart are a number of dash lines, which meet at the point for 100 per cent natural gas. These lines represent mixtures of catalytically reformed natural gas and natural gas (marked number 4), thermally reformed natural gas and natural gas (marked number 7), and thermally reformed oil gas and natural gas (marked number 12). These lines have been added to Figure 4 to give a composite comparison of the characteristics of the various base gases.

By inspection, point S is seen to be above each of the superimposed lines; therefore, this gas can be made by each of the base gas mixtures.

By interpolation, in Table 8 are the characteristics of the four base gases at point S.

This demonstrates the manner in which the charts, and characteristics, can be compared, and the type of information that can be derived from them.

b. Effect on production possibilities if the natural gas should vary in characteristics

As natural gas is drawn continually from the well, it has a tendency to decrease in Btu content, and to rise in specific gravity. Therefore a second question to be answered was: If natural gas changes in composition, how will it affect the ability to produce the base gases?

Let us assume that the natural gas will change from 1040 Btu to 1020 Btu, and the specific gravity will change from 0.62 to 0.66. This change will cause a relocation of the gas lines 1, 4, 7, and 12 in Figure 4, to their new location as shown in Figure 5.

Inspection of Figure 5 shows that point S is *above* only two (1 and 7) of the base gas lines which are for mixtures with coke oven gas and catalytically reformed natural gas. Therefore, since point S remains *above* the relocated pro-

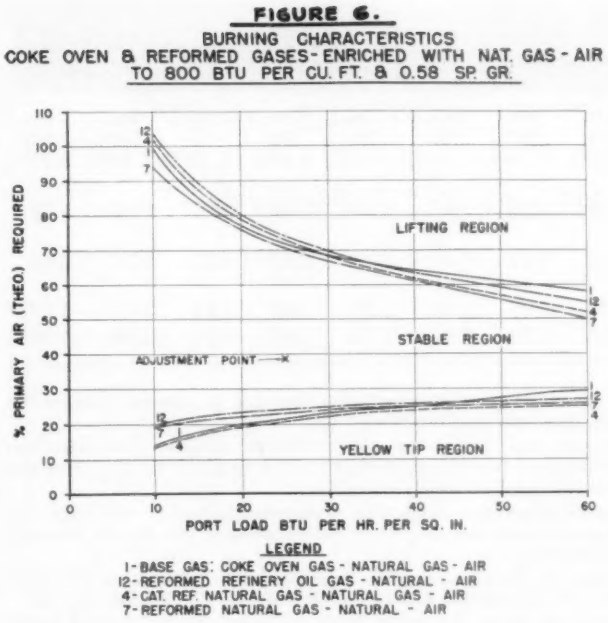


FIGURE 6.
BURNING CHARACTERISTICS
COKE OVEN & REFORMED GASES - ENRICHED WITH NAT. GAS - AIR
TO 800 BTU PER CU. FT. & 0.58 SP. GR.
% PRIMARY AIR (THEO.) REQUIRED
LIFTING REGION
STABLE REGION
ADJUSTMENT POINT
YELLOW TIP REGION
PORT LOAD BTU PER HR. PER SQ. IN.
LEGEND
1 - BASE GAS: COKE OVEN GAS - NATURAL GAS - AIR
12 - REFORMED REFINERY OIL GAS - NATURAL - AIR
4 - CAT. REF. NATURAL GAS - NATURAL GAS - AIR
7 - REFORMED NATURAL GAS - NATURAL - AIR

FIGURE 6.
Lifting and Yellow Tip Limit Curves of Four Base Gas Mixtures.

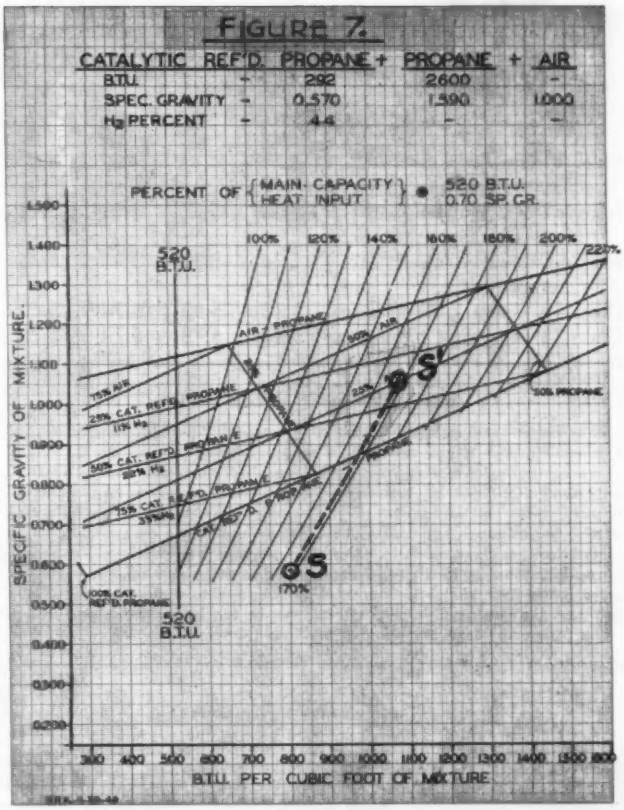


FIGURE 7.
CATALYTIC REF'D. PROPANE + PROPANE + AIR
B.T.U. - 292 2600 -
SPEC. GRAVITY - 0.570 1.590 1.000
H2 PERCENT - 44 - -
PERCENT OF (MAIN CAPACITY / HEAT INPUT) @ 520 B.T.U. 0.70 SP. GR.
SPECIFIC GRAVITY OF MIXTURE
520 B.T.U.
AIR - PROPANE
S
S'
S''
170%
B.T.U. PER CUBIC FOOT OF MIXTURE

FIGURE 7.
Supplemental Gas Mixture—Catalytically Reformed Propane, Propane, and Air.

duction gas-natural gas line, the gas mixtures can be produced.

Further inspection shows that point S is *below* two relocated production gas-natural gas lines; the gas mixtures cannot be produced. In this event three choices present themselves:

(1) Change the base gas to some values that will fall above the new relocated four gas lines or (2) increase the Btu content of the mixture along the constant heat input line, until the point does fall above the new relocated carrier gas-natural gas line, as for instance at S^1 on Figure 5; or (3) change the production characteristics of the production component (as for example, No. 4) to drop the line below point S.

This problem was exaggerated somewhat in order to demonstrate the manner in which the charts may be used to analyze various conditions and characteristics, and what should be done in production to counteract adverse conditions.

c. Interchangeability of proposed base gas mixtures

After it was decided that the selected four base gas mixtures could be produced, it was necessary to check their interchangeability one with another. For this purpose, test installations were made at the Tilghman Street plant and at the West Conshohocken plant.

The apparatus consisted of a specially designed test burner and suitable gas and primary air connections. The gas mixture to be tested was prepared in a laboratory gas holder according to a predetermined analysis, and carefully checked for Btu and specific gravity. From the holder the gas flowed through a rotometer to the test burner. The primary air was stored in another laboratory gas holder from which it flowed through a rotometer to the test burner. With this arrangement the primary air and gas flows could be proportioned accurately.

The first gas tested was the mixture of coke oven gas, natural gas, and air, which is the "major" base gas. The gas flow was adjusted for a port load of 25,000 Btu per square inch; the primary air flow was adjusted to 40 per cent of the theoretical amount required for complete combustion. The flame characteristics were excellent. Next, the flows of gas and air were changed in order to obtain the limits for lifting and for yellow tipping. The results of these tests are shown on Figure 6 and are represented by the lines numbered 1.

Similarly, the other base gas mixtures were tested and Figure 6 shows their lines of performance.

Figure 6 shows the limit lines of the

(Continued on page 44)

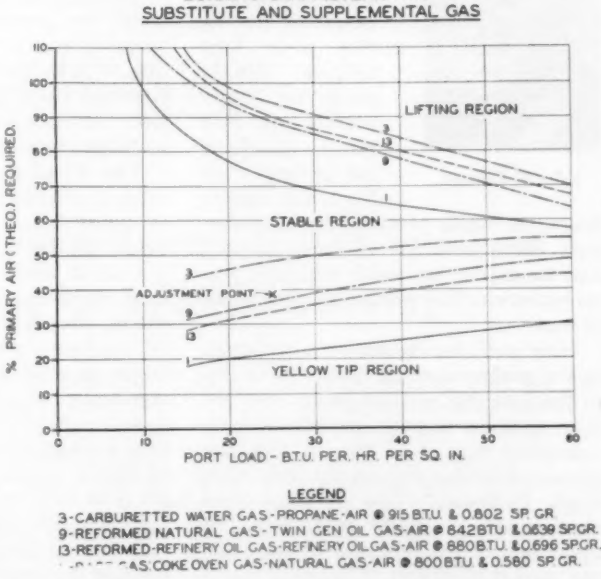


FIGURE 8.
BURNING CHARACTERISTICS
SUBSTITUTE AND SUPPLEMENTAL GAS
% PRIMARY AIR (THEO.) REQUIRED
LIFTING REGION
STABLE REGION
ADJUSTMENT POINT
YELLOW TIP REGION
PORT LOAD - B.T.U. PER HR. PER SQ. IN.
LEGEND
3 - CARBURETTED WATER GAS - PROPANE - AIR @ 915 B.T.U. & 0.802 SP. GR.
9 - REFORMED NATURAL GAS - TWIN GEN OIL GAS - AIR @ 842 BTU & 0.639 SP.GR.
13 - REFORMED - REFINERY OIL GAS - REFINERY OIL GAS - AIR @ 880 BTU & 0.696 SP.GR.
COKE OVEN GAS - NATURAL GAS - AIR @ 800 BTU & 0.580 SP. GR.

FIGURE 8.
Lifting and Yellow Tip Limit Curves for Some Substitute and Supplemental Mixtures.

Index of Yields : Selected Utilities Stocks

	Nov. 1951	Oct. 1951	Sept. 1951	Aug. 1951	July 1951	June 1951	May 1951	Apr. 1951	Mar. 1951	Feb. 1951	Jan. 1951	Dec. 1950
Natural Gas Transmission Companies	4.51%	4.67%	4.67%	4.65%	5.07%	5.26%	5.35%	5.22%	5.38%	5.31%	5.36%	5.97%
Natural Gas Transmission & Distribution Companies	5.30	5.36	5.09	5.11	5.24	5.30	5.45	5.43	5.35	5.31	5.47	5.67
Manufactured & Mixed Gas Companies	5.36	5.32	5.43	5.46	5.52	5.22	5.35	5.23	5.22	5.21	5.22	5.56
Class "A" Electric Companies	5.78	5.83	5.74	5.69	5.97	5.95	5.88	5.52	5.49	5.65	5.62	6.19
Class "B" Electric Companies	5.82	5.78	5.74	5.78	5.86	5.88	5.94	5.72	5.66	5.78	5.80	6.38

Method of Compiling Index of Yields

This is a straight arithmetical index of comparative yields obtainable on a selected group of gas and electric utility industry common stocks.

The companies comprising this index have been selected by the AMERICAN GAS JOURNAL as providing a representative cross-section of each industry, from the standpoint of geographical diversification and of the relative importance of the individual companies in their areas.

No effort has been made to weight the average to give effect to changes in capitalization or in dividend rates because the yields afforded on the issues reflect such changes. The index is designed to show the rate of return and not necessarily market movements on the stocks comprising it.

The companies used in compiling this index are:

Natural Gas Transmission Companies: El Paso Natural Gas Co.; Northern Natural Gas Co.; Panhandle Eastern Pipe Line Co.; Southern Natural Gas Co.; Tennessee Gas Transmission Co.

Natural Gas Transmission and Distribution Companies: Columbia Gas System, Inc.; Consolidated Natural Gas Co.; Lone Star Gas Co.; Oklahoma Natural Gas Co.; Pacific Lighting Corp.

Manufactured and Mixed Gas Companies: Bridgeport Gas Light Co.; Brooklyn Union Gas Co.; United Gas Improvement Co.; Peoples Gas Light & Coke Co.

Class "A" Electric Companies: Boston Edison Co.; Commonwealth Edison Co.; Houston Lighting & Power Co.; Southern California Edison Co., Ltd.

Class "B" Electric Companies: Dayton Power & Light Co.; Hartford Electric Light Co.; Pennsylvania Power & Light Co.; Public Service Co. of Colorado; San Diego Gas & Electric Co.

John F. Falvey

CROSS currents in the security markets have become more pronounced during the past few weeks. While prices for public utility common stocks currently are at about their high for many years, the yields provided on the industry's bonds continue to creep upward and the market for utility company preferred stocks has practically fallen out of bed.

How great has become the weakness in the preferred stock market is shown in the fact that on one recent day just prior to going to press, preferred stocks accounted for 24 of the 36 new low prices set for the year on the New York Stock Exchange. Nine of these lows were made by utility preferreds. To quote one of the foremost of the security market observers: "Preferred stocks currently are without friends. Last week more than 60 of these issues listed on the New York Stock Exchange sold at new 1951 lows."

The oddity of the situation is that utility preferreds of individual companies were falling to new low price levels at the exact time that the same companies' common shares were reaching to new high marks for the year.

To give the devil his due, however, a preferred stock is "neither fish nor fowl." It does not have the investment characteristics of a bond since it is merely a part of the proprietorship interest in the enterprise. As such it is not entitled to creditor standing but merely to priority over the common stock in its claim on earnings and assets. Conversely, because of its fixed income return it lacks the appeal imparted to the common stock by the claim which the latter has to greater dividend return as earnings increase.

The disintegration of the preferred stock market has added to the problems of utility management in raising new money to finance construction. If they are not to dilute earnings for the common stock by offering too many new shares, they have no alternative but to fall back on a greater percentage of new bonds in their search for capital. And regulatory agencies presumably will have to forego, for a temporary period, their previous insistence on maintenance of liberal equity ratios if the financing job is to be done on anything akin to a favorable cost basis.

Rising yields on new bonds have brought the cost of soundly rated investments to a 3⅝ per cent coupon rate with a slight premium to the borrower, and there is nothing on the horizon at the moment to indicate that this is a passing phase. Higher bond yields are here to stay.

A most favorable aspect of the utility financing situation has been the proportion of common stock which has been issued to finance property additions. In this respect the electric utilities and combination companies have given a better account of themselves than have the gas companies. Of the $1,054 million which the electric utilities raised in the first ten months of 1951 $294.5 million (28 per cent) represented common stock, whereas common stock financing of $264 million had accounted for 25 per cent of the $1,065.5 million of new money raised in the entire calendar year 1950.

As against this, the gas companies raised $206,341,000 (or 14.4 per cent) of their needed funds in the nine months ended September 30, 1951, from sale of common stock, compared with $271,937,000 (14.9 per cent) from this source in the calendar year 1950.

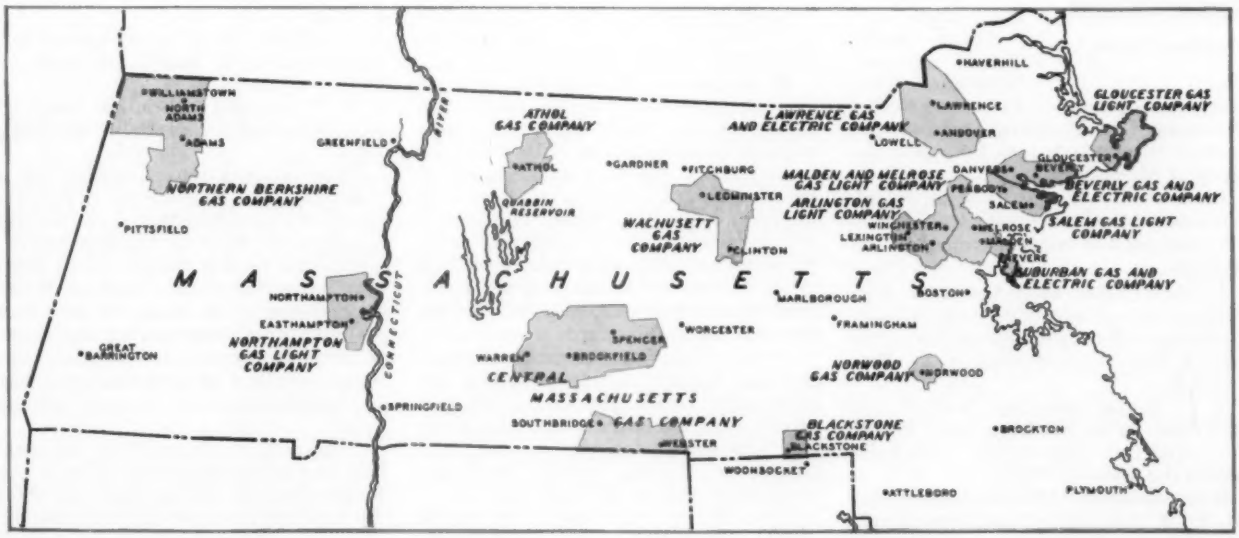
The gas industry will close 1951, however, with the second best year from the standpoint of new money common stock financing, with the total falling only slightly short of the record high level reached in 1950.

Utility managements can look back to 1951 as a year of worthwhile accomplishment from the standpoint of financing, chiefly the use of common stocks to raise as great a proportion as possible of the new capital needed for expansion.

Time alone will tell, but the various indices now point to possibly more difficult common stock financing over the coming year as the eddying currents in the financial picture give signs of flowing against equities. First and probably foremost in this respect is the likelihood that corporate management of all types in 1952 will have to cut back on their recent dividend liberality as their tightening financial situation forces them to

(Continued on page 46)

New England Electric System Sells Massachusetts Gas Properties



Areas in color are the territories served by New England Electric System gas companies which have been sold to a group headed by Lehman Brothers and Bear, Stearns & Company.

14 Gas Holdings Bought by Lehman Bros. Group for $22,780,000 Plus

NEW ENGLAND Electric System accepted a proposal for the purchase of all its system gas properties in Massachusetts on October 2. The purchasers, headed by Lehman Brothers and Bear, Stearns & Company, bid $22,780,000 for the investment of NEES at the beginning of 1951 in Arlington Gas Light Company, Athol Gas Company, Blackstone Gas Company, Central Massachusetts Gas Company, Gloucester Gas Light Company, Malden and Melrose Gas Light Company, Northampton Gas Light Company, Norwood Gas Company, Salem Gas Light Company and Wachusett Gas Company.

Also involved was the purchase of the gas properties and inventories owned by Beverly Gas and Electric Company, Lawrence Gas and Electric Company, Northern Berkshire Gas Company and Suburban Gas and Electric Company.

An additional amount of money is to be paid NEES for the cost of net changes from January 1, 1951 to the time of sale.

Five other bids were received; one for Norwood Gas, one for Northampton Gas, one for the gas assets of Lawrence Gas and Electric, and two for all of the gas properties in Massachusetts. These bids were all below the value of system investments.

Before the transfer of ownership can be arranged and the date of sale set, approvals must be obtained from the Securities and Exchange Commission and the Massachusetts Department of Public Utilities. In the interim, all companies will continue their programs toward the conversion to natural gas.

The companies involved in the transaction serve approximately 208,000 customers. Sales of gas in 1950 for the group amounted to more than 8,126,000 Mcf.

Estimated expenditures by the 14 companies for peak shaving and standby equipment in connection with the use of natural gas amount to $2,186,000.

The purchasers declare it to be their intention to retain or cause to be retained all the present active gas personnel of each gas and combination company through the level of local operating management. Approximately 1100 employes are involved. Employes so retained will continue to have insurance benefits now available under the NEES retirement and group insurance plans, or a similar plan.

With the sale of the gas properties in Massachusetts, the only remaining gas holdings of the New England Electric System are the Warren-Bristol and Westerly gas divisions of The Narragansett Electric Company in Rhode Island.

No plans for the disposition of these properties have been announced as yet.

Wisconsin Utilities Association Holds Convention With Record-Smashing Attendance of 639

Albert Smith

Attendance at the gas and electric convention of the Wisconsin Utilities Association, held at Milwaukee, November 14-16, broke all previous records. A total of 639 registered for the sessions.

Albert Smith, district manager, Northern States Power Co., Chippewa Falls, was elected chairman of the Technical Division, Gas Section. He succeeds J. C. Bolender, formerly of Milwaukee.

Maurice Lewis, gas superintendent, Wisconsin Michigan Power Co., Appleton, was elected vice-chairman of the division.

J. H. Mikula, sales manager, Milwaukee Gas Light Co., was elected chairman of the Gas Division, Sales and Service Section, succeeding A. G. Bur, Green Bay.

S. L. Hagen, manager, promotional sales department, Northern States Power Co., Appleton, was elected vice-chairman of the division.

J. Levendusky, Milwaukee Gas Light Co., told the delegates how Milwaukee is converting its distribution system to intermediate high pressure.

He said: "The anticipated large increase in house heating and commercial load due to the introduction of natural gas presented a problem of supply to our customers on our low pressure system. It was apparent that this increased load could not be handled by the existing low pressure system. Consequently, plans for improving the supply were studied. The most economical and practical way of accomplishing this was to install house regulators.

"Our over-all picture calls for the installation of approximately 100,000 house regulators. This program covers the entire city with the exception of the downtown area. At present we have completed 23 per cent of the program with very good results. In the elevated areas we no longer have to clean mains and our supply is more than adequate for the increased load."

Norman Burzlaff, Milwaukee Gas Light Co., in describing the various steps involving pressure in distribution systems, said:

"The introduction of natural gas in Milwaukee brought with it a great increase in the use of house heating and industrial use. This increase created a distribution problem. The only solution was to increase the pressure in the low pressure distribution system. On Dec. 6, 1949, the Milwaukee Gas-Light Co. began taking applications for house heating and industrial use. To our surprise the trend to gas heat was almost as great in the older sections of town as it was in the newer sections.

"On the day of pressure elevation as the crews began to close the valves on the large low pressure feeder mains, pressure was increased on regulators to 12 to 15". Pressure was held at this level for several weeks so that any regulators that had been missed could be detected by the consumer having excessive pressure. The main and service inspection department could check services and mains for leaks and enable the street department to repair any leaks detected."

R. G. Koch, Milwaukee Gas Light Co., reported that a special association committee of which he is chairman, worked in cooperation with a special committee of the American Society of Heating and Ventilating Engineers in the formulation of proposed revisions in the state heating and ventilating code. Proposed revisions have been submitted to the Industrial Commission which expects to act upon proposed changes before the end of this year.

Monroe Boettcher, chemist, Milwaukee Gas Light Co., reported that the Milwaukee Gas Light Co. is using a titrilog as an aid in the odorization of its gas. "Our gas is odorized," he said, "at a set rate and this rate is pretty much determined by our weekly sniff tests.

"The titrilog, with just a few simple calculations, will give us our odorizing rate in either gallons or pounds per MM. Our odorant is reported in pounds per MM. As a check on the instrument, we use the calculation in gallons per MM against our flowrator which is also in gallons per MM. When we get this check, we know our rate in pounds per MM is correct.

"Our titrilog is also a monitor," he said, "on the odorizer itself. By that I mean, if for some mechanical failure or other reason, it might flood or be shut off for some period of time, this flooding or shut off would be indicated on the titrilog.

"We have found the instrument to be accurate and the results are easily and rapidly obtained."

D. L. Hayner, Milwaukee Gas Light Co., speaking on cathodic protection, said:

"The introduction of natural gas to Wisconsin saw the various utilities engaged in an unprecedented construction program. At the time the problem was getting the lines installed and in operation. After things had simmered down a bit and operations began to look more or less normal, engineering and operations staffs began to consider other things pertinent to long time operations and maintenance of the newly installed lines.

"The matter of protecting these new lines was an important one. How to keep maintenance to a minimum and obtain the maximum useable life from the new lines was another. Fortunately, cathodic protection can greatly assist coating, etc. in providing nearly maximum protection.

"Cathodic protection is a long term investment due to the results not being readily apparent. Any form of protection which will retard or prevent corrosion is a step in the right direction to combat a menace which costs American industries an estimated six billion dollars annually."

R. D. Hayes, president, Sales Analysis Institute of Illinois, Inc., Chicago, outlined the problems that the average sales supervisor meets in handling salesmen and suggested some solutions to these problems. He said that a sales supervisor's position is no different than a supervisor's position in any other field of endeavor. A good many sales supervisors are capable of doing an excellent job of selling when talking to the prospect, but forget to use the same principles in human relations when dealing with one of their own employes.

E. Carl Sorby, Geo. D. Roper Corporation, emphasized the need of the gas industry to take seriously its obligation toward its public and its dealers.

He stressed the need for utility merchandising in the establishment of sales standards in all communities, offering as proof the devastating effect that price cutting, chiseling, and notorious merchandising methods are having on the public and its faith in the industry.

He emphasized the need for utilities promoting and selling top quality, high

(Continued on page 39)

New Safety Score Board Now Available

Industrial Products Company, of Philadelphia, announces a new safety record sign. Designed to act as a constant reminder of days worked without a lost time injury, it conveys the thought that responsibility rests with each and every employee.

The safety scoreboard is 20" wide by 30" high, finished with green background and white letters. It has two blackboard finish panels enclosing the word "days" so that it may be kept up to date by marking in with chalk.

It is manufactured of 20-gauge metal and finished in baked dulux, and is suitable for both indoor and outdoor use.

Law Suits Involving Personal Injury Present Many Intricacies

by Leo T. Parker

Attorney at Law, Cincinnati

QUITE recently a city won an important law suit in the higher court after adverse verdicts rendered by the jury, trial Judge and the Court of Appeals. This litigation involved a suit for heavy damages filed by one Mrs. Hood for injuries sustained when she slipped in slick and slippery mud in an alley or cross walk. The excellent briefs and arguments in this case were prepared by able lawyers. I shall quote liberally so that readers may well understand concise arguments and distinctive explanations necessary to win a damage suit of this nature that may be filed against either a municipality or gas corporation.

The facts of this important case are as follows: Mrs. A. L. Hood was walking along the sidewalk in a residential area on October 24 when she came to the mouth of an alley. She stepped down into this alleyway. When crossing the alley, she stepped into mud which was, according to all of the testimony, not more than two inches deep.

Further testimony showed that employes of the city were constructing a gas line under a concrete apron that slopes downwardly toward the street. The city's employes filled the holes in the alley and cleaned the concrete apron the afternoon before the accident. This work was done in an orderly fashion and without negligence. Soon after the employes had cleaned up this alley, a hard rain fell and the rain washed considerable dirt from a hole that had been previously filled in the street. This dirt was washed into the mouth of the alley and formed mud which was smooth and not in ridges. Mrs. Hood had almost crossed the alley the following day in broad daylight and she was about to step up on the sidewalk when she slipped in the mud, sustaining serious injuries. During the trial Mrs. Hood testified that she knew the dirt and mud were there, and also that it was smooth and that it did not look dangerous.

Arguments presented in favor of the city are as follows:

"The court erred in not directing the verdict for the defendants (city) because under the uncontradicted evidence, the defendants (employes) had cleaned off the sidewalk the afternoon before the accident, and there is no proof that the defendant (city) had actual or constructive notice of any mud on the sidewalk on October 24th."

"The court erred in not directing a verdict for the defendant (city) because of the testimony of Mrs. A. L. Hood, which convicts her of contributory negligence as a matter of law. She testified that she knew that the excavation had been going on and she knew that the mud was present where she was walking and had walked previously across the alley in the mud before she fell, and further there was, under her own evidence, a safe way that she failed to avail herself of."

"The court erred in not directing the verdict for the defendant (city) because the proof shows that there was no negligence on the part of the defendants, and the defendants are not charged with the duty, under the law, of keeping all mud from the walkways or sidewalks."

In other words, the testimony showed, first, that the city's employes had cleaned off the dirt; second, that during the night a heavy rain had washed the dirt forming mud into the alley entrance; third, Mrs. Hood was walking along the sidewalk in broad daylight, knowing that construction had been going on at the mouth of the alley, when the accident happened; and, fourth, the accident happened not on the sidewalk proper, but at the mouth of the alley, or crosswalk.

The counsel in this case argued that Mrs. Hood was guilty of contributory negligence as a matter of law, based on the following legal propositions:

She could not assume that the mouth

(Continued on page 40)

TRAINING SCHOOL FOR WAITRESSES HELD AT PORTLAND

Portland (Ore.) Gas & Coke Company and the Associated Restaurants of Oregon jointly sponsored a 5-day training school for waitresses conducted by John B. O'Meara, famous restaurant consultant (right) who didn't think this wrong-way demonstration of order-taking was so terribly funny!

Pennsylvania Cooperation

(Continued from page 18)

Many retailers proved either incapable or incompetent to present any convincing selling talk on the merits of modern gas equipment. Others had given in to the prevailing impression that in some way electricity in the home is modern, whereas gas is by comparison old-fashioned and outmoded.

Out of the 35 dealers shopped, it was found that 24 were disposed to recommend electric ranges where the customer expressed no decided preference. Dealers' floor salesmen in many cases proved to be either misinformed or uninformed on modern gas features, and the competitive claims of electrical promotion were allowed to go unchallenged.

To remedy this unfavorable situation in the rich Pennsylvania market, a program of action was devised, with the assistance of Beaumont Heller and Sperling, a Reading, Pa., advertising agency.

The broad general outline of the plan includes:

1. Radio announcements to reach an estimated audience of five million people in the area
2. Repeated showing on 182 billboards across Eastern Pennsylvania
3. Full page newspaper advertising in Sunday magazine sections to reach over a million homes
4. Training in sales techniques for appliance dealers and their employees
5. Publicity stories on gas and its advantages, to be released to all newspapers in the area

In addition to the five points outlined, sales helps will be made available to gas utilities, LP gas dealers and distributors. These will include window poster sets, appliance labels, sales force mailings, envelope stuffers and a variety of other material. An extensive program of participation in cooking schools, shows and county fairs will be tied in with the activity.

H. R. Zeamer of The Philadelphia Gas Works Company, who presided at the luncheon meeting, announced that the following gas utilities had already agreed to support the program: Allentown-Bethlehem Gas Company; Central Pennsylvania Gas Company; Consumers Gas Company; The Harrisburg Gas Company; Lancaster County Gas Company; Lebanon Valley Gas Company; Penn Fuel Gas Company; Pennsylvania Gas Management, Inc.; The Philadelphia Gas Works Company; Scranton-Spring Brook Water Service Company; The United Gas Improvement Company and York County Gas Company. Actively identified with the movement and supporting it financially are the Pennsylvania LP Gas Association, its members and dealers, and numerous manufacturers of appliances and equipment.

LIONEL BARRYMORE BROADCASTS 'A CHRISTMAS CAROL' DEC. 23—A. O. SMITH WATER HEATER IS SPONSOR

Lionel Barrymore and S. E. Wolkenheim, A. O. Smith water heater marketing director, complete arrangements for Mr. Barrymore's 17th annual performance of "A Christmas Carol."

AGAIN this year, the water heater division of the A. O. Smith Corp., Kankakee, Ill., is sponsoring the traditional Christmas broadcast of Lionel Barrymore's performance of "A Christmas Carol," supported by an all-star cast. A. O. Smith, manufacturer of Permaglas automatic water heaters, is sponsoring the Charles Dickens' classic on behalf of its more than 10,000 dealers throughout the United States.

S. E. Wolkenheim, A. O. Smith water heater marketing director, says the program will be carried from coast to coast as well as in Canada and the Hawaiian Islands on more than 500 stations of the Mutual Broadcasting System. It will be put on the air at 4 p.m. Eastern Standard Time, Sunday, December 23, with a possibility of a delayed broadcast on Pacific Coast stations. On the basis of listener rating surveys, it is estimated that the program will be heard by more than 14,000,000 people.

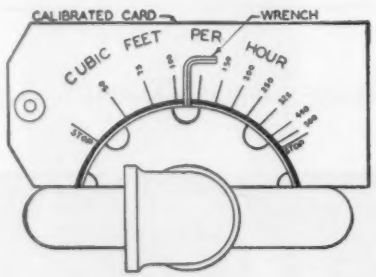
The water heater division of A. O. Smith is supplying its dealers with a complete promotional package so that they can exploit the program in their own areas.

Three-color window streamers are being supplied, as well as newspaper ad mats and copy for local radio spot announcements. Also available are special announcement postcards which dealers may mail to their customer lists as a reminder to listen to the broadcast.

It was 17 years ago that Mr. Barrymore first portrayed Ebenezer Scrooge in Dickens' immortal story of Tiny Tim. Since that time, to millions of radio listeners all over America, "A Christmas Carol" has become a traditional family event in the observance of Christmas.

Roberts-Gordon Makes Orifice Adjustment Simple

The Roberts-Gordon Appliance Corporation, Buffalo, builders of Gordon conversion gas burners, has recently issued a card as an aid to installers in quickly adjusting the patented "Iris" orifice for required gas input.



Shipped with each unit is a double tag —one half devoted to the diagrammatic instructions; the other half to a calibrated card titled "cubic feet per hour."

To adjust the input, the installer places the card between the bell and the wrench so that the calibrated curve matches the air shutter. He next moves the wrench to the input desired. Result is a quick approximate setting which saves considerable time. A chart is provided on the reverse side of the card to compute the input after timing the revolution of the test hand on the meter as a check on the calibrated card setting.

Space Heaters Are Essential GAMA Brochure Declares

The importance of space heating as a factor in the defense program is the subject of a brochure submitted to top federal government officials by the Direct Heating Equipment division of the Gas Appliance Manufacturers Association.

The 12-page brochure, prepared by the division's defense regulations committee, stresses three points:

1. Adequate heating is necessary to public health and morale.
2. Nearly half of the homes in the nation—20,118,000 out of 42,520,000—use space heaters.
3. Gas-fired space heaters require less of the most critical materials than other type of heating equipment of similar capacity.

The GAMA study, according to Committee Chairman T. D. Bromley, is intended to aid allocation officials in apportioning materials to needed heater production without interfering with defense output.

AGA Appoints New Committee To Study Public Relations

The Executive Board of the American Gas Association has authorized the appointment of a public relations committee to decide whether an industry program of public relations should be instituted and, if so, its nature, and how it should be financed and operated.

Ernest R. Acker, president, Central Hudson Gas and Electric Company, Poughkeepsie, has been appointed chairman of the committee. Members include: F. M. Banks, president, Southern California Gas Company, Los Angeles; F. D. Campbell, president, New England Gas and Electric Association, Cambridge; E. S. Fields, vice-president, The Cincinnati Gas and Electric Company, Cincinnati; W. H. Ligon, president, Nashville Gas Company, Nashville; Remick McDowell, vice-president, The Peoples Gas Light and Coke Company, Chicago; Chester L. May, vice-president, Lone Star Gas Company, Dallas; F. T. Parks, vice-president, Public Service Company of Colorado, Denver; and Claude A. Williams, president, Transcontinental Gas Pipe Line Corporation, Houston.

By Any Chance—Interested mayors of communities take part in Consumers Power allocation of gas heating. Left to right are: Vernon Christenson, Consumers industrial engineer; Mayor Mrs. Maxine Weston Clarey, of Auburn; George Hillman, Midland Consumers manager; Mayor Clarence Maturen, of Essexville; Louis A. Vaupre, Consumers division manager; and Mayor E. A. Cederberg, of Bay City.

Consumers Power Co. Uses Lottery to Grant House Heating to 10,000 out of 37,000

Connection of 10,000 additional gas space heating customers has been a major project of the Consumers Power Company in Michigan since the third week of October, when lotteries were held to decide who among the applicants would obtain the service.

Final figures show that a total of 37,316 residents of Consumers' gas distribution areas applied for service.

The allocation of 10,000 jobs was authorized by the Michigan Public Service Commission and the Petroleum Administration for Defense after the company had submitted evidence that it could serve the additional 10,000.

In all of the 11 divisions which serve gas customers, lotteries were necessary to select the winning applicants. The biggest demand for space-heating was in the southeast division, where 15,053 persons applied for the 3,546 connections permitted under the program.

Other divisions reported the following statistics:

Division	Applications	Quota
Battle Creek (Marshall)	223	53
Bay City	2,387	662
Central	657	132
Flint	5,070	1,734
Jackson	1,989	631
Kalamazoo	3,101	848
Lansing & Hastings	5,203	1,289
Owosso	714	228
Saginaw	2,919	877

The company estimated that the 37,316 applications would have been approximately doubled if the offer to connect new customers had been made earlier in the fall, before many people began to heat their homes.

M. A. HOGWOOD AND W. K. NUSSBAUM HONORED BY MID-SOUTHEAST ASS'N

W. K. Nussbaum was elected president for the coming year and M. A. Hogwood was named "Gas Man of 1951" at the 13th annual meeting of the Mid-Southeastern Gas Association, held Nov. 7-9 at the Sir Walter Hotel, Raleigh, N. C.

Mr. Nussbaum, vice-president of the Savannah Gas Co., succeeds J. D. Barnes, general manager of the Piedmont Gas Co., Hickory, N. C. Other officers of the association for the coming year are:

First vice-president, A. T. Carper, Durham, N. C.; Second vice-president, Lee E. Hurst, Charlotte, N. C.; secretary-treasurer, Edward W. Ruggles, director of the College Extension Division, North Carolina State College, Raleigh.

Offered for the first time, the "Gas Man of the Year" award will be an annual feature. The 1951 honor went to "Mike" Hogwood, supervisor of distribution, Public Service Co. of North Carolina, Raleigh, "because he truly represents the highest ideals of our industry." Presentation was made at the annual banquet by Past President Eugene Leier.

A warning note regarding steel for pipe lines was struck by Hugh Lamberth, of the Petroleum Administration for Defense, who said that there is growing sentiment in Washington that the gas industry has expanded so fast and so far that further growth in the near future may be studied most carefully by government officials.

A dozen members of the Gild of Ancient Supplers gathered at breakfast November 9 to hear Association Secretary Ruggles describe the new Institute of Gas Technology to open Jan. 14 at North Carolina State College.

Brooklyn Union Engineer Given Special Award

The Brooklyn Union Gas Company recently made H. B. Wilson, manager of its commercial sales section, the recipient of a special award in recognition of his pioneering work in the development of new gas utilization.

During the past five years Mr. Wilson has not only extended the use of gas in the field of commercial cooking, water heating, and space heating; but has, as well, designed the equipment necessary to put his ideas into practice. This equipment is used by four of the major airlines in addition to many leading restaurants, hospitals, apartment houses, and other institutions throughout the United States.

The citation accompanying the award, which was presented by H. H. Cuthrell, president of the utility, said in part: "By successfully concluding all phases of his program, Mr. Wilson has performed a great service for Brooklyn Union and for the gas industry. (This award is given) in recognition of his imagination, knowledge, and perseverance."

News of the Gas Industry

Holloway Retires as President Of San Diego; Sherwin Elected

Emery D. Sherwin, vice-president in charge of operation, San Diego Gas & Electric Company, was elected president October 22, L. M. Klauber, chairman of the board and chief executive officer of the company, announced.

A. E. Holloway, now president, after 41 years' service with the company, retired November 1 in accordance with the provisions of the organization's retirement plan. He will continue to serve on the board of directors of which he has been a member since 1912.

Mr. Holloway started with the utility as a salesman in 1910 and has served in many capacities with the company. In 1911 he was appointed manager of new business, commercial superintendent in 1921, and vice-president in charge of sales in 1932. He assumed the presidency in 1949.

Mr. Sherwin's association with the San Diego company dates back to 1915. Since then he has served in many phases of the utility's business. In 1932 he was appointed assistant general superintendent, then general superintendent in 1941, and finally vice-president in charge of operation in 1944. He has been a member of the board of directors since 1944.

Harold A. Noble was elected vice-president in charge of operation succeeding Mr. Sherwin.

Mr. Noble is also a long-time employee of the San Diego Gas & Electric Company, starting in 1925. He, too, has worked in many capacities, including construction engineer, and has been serving as general superintendent since 1947.

Miss Dowler Is Home Service Committee Chairman

Miss Flora G. Dowler, supervisor of home service activities, The Manufacturers Light and Heat Company, Pittsburgh, has been appointed chairman of the 1952 Home Service Committee of the American Gas Association.

Miss Dowler directs the home service activities in the area served by the Pittsburgh Group Companies in the Columbia Gas System. She heads a staff of 27 home service workers, 23 of whom are located in service centers in the field.

The new chairman of the Home Service Committee is a graduate of Ohio State University. Her entire business career has been in home service work, starting with the Ohio Fuel Gas Company in Columbus, then moving to the Virginia Gas Distribution Corporation, at Staunton, Virginia, and the Binghamton Gas Works at Binghamton, New York, before assuming her present Pittsburgh duties.

H. C. Mefford Retires as V-P, Gen. Mgr. of United Fuel; E. D. Bivens Succeeds Him at Charleston

H. C. Mefford, Sr.

E. D. Bivens

H. C. Mefford, Sr., vice-president and general manager of the United Fuel Gas Co., Charleston, W. Va., retired on November 1 and was succeeded by E. D. Bivens who had been vice-president and assistant general manager.

Mr. Mefford has had 39 years of service with the Charleston Group of the Columbia Gas System, and is a recognized authority in the field of gas dispatching. Because of his intimate knowledge of gas dispatching he is widely known throughout the gas industry.

He started with the Charleston Group in 1912 as a workman in the gas fields. Two years later he became an operator of the United Fuel Gas measuring station near Milton, W. Va. He was made superintendent of the pressure department in 1929, and his appointment as general superintendent was made in 1944.

He was elected vice-president of United Fuel Gas in 1946 and became vice-president and general manager of all Charleston Group companies in 1950.

Mr. Bivens, a native of West Virginia, entered the gas industry in 1929 as assistant treasurer of Ohio Fuel Gas Co., Columbus. From 1932 to 1939 he served as treasurer and a director of that company. He then went to New York and served as treasurer, director and accounting officer of Columbia Engineering Corp., and in 1947 was named treasurer of the Columbia Gas System.

In May 1951, Mr. Bivens went to Charleston as vice-president and assistant general manager of United Fuel Gas and the associated Columbia companies in the Charleston Group.

E. H. Wood Made Chief Engineer Of Memphis Gas Division

Eugene H. Wood has been appointed chief engineer of the gas division of Memphis Light, Gas and Water Division, according to an announcement by W. A. Dunkley, director of the gas division. Mr. Wood has been assistant chief engineer, and takes the place of H. G. Howell, who resigned recently to enter private business.

Mr. Wood graduated in mechanical engineering from the University of Tennessee in 1935. He was employed by the Light, Gas and Water Division in 1936 as a design engineer. During World War II he was chief draftsman in the Maintenance Department of the Chickasaw Ordnance Works at Millington, Tenn. He returned to the Light, Gas & Water Division in 1945 and served as assistant superintendent of gas operations and later as assistant chief engineer in the Gas Division.

Borger Heads AGA Committee On Economics

E. M. Borger, president, Peoples Natural Gas Company, Pittsburgh, has been appointed chairman of the committee on economics of the American Gas Association, it was announced by George F. Mitchell, president, The Peoples Gas & Coke Company, Chicago, and new president of AGA.

The committee on economics is sponsoring a long range study on the economics of gas house heating.

James M. Elliott Is Promoted By United Natural Gas

H. S. Rose, president of United Natural Gas Company, Oil City, Penna., has announced the resignation of William B. Black, chief industrial sales engineer, who has accepted a position with Fairmont Wall Plaster Company, Fairmont, West Virginia.

Simultaneously, Mr. Rose announced the appointment of James M. Elliott, to the post vacated by Mr. Black.

Mr. Elliott, a graduate of Clarkson College of Technology, joined the United Natural Gas organization in 1948 as an assistant engineer in the mechanical engineering department. He was transferred to the industrial sales department in 1950.

Walter L. Chewning Dies Suddenly

Walter L. Chewning, gas consultant for Day & Zimmermann, Inc., died suddenly at his home in Cynwyd, Penna., on November 11. He was 70.

Mr. Chewning, a well known gas engineer, retired from active duty with Day & Zimmermann Inc. about five years ago and has since been employed by them and others as a gas consultant.

He was born in Richmond, Va., graduated from Virginia Polytechnic Institute, after which he attended Stevens Institute of Technology where he received, in 1902, the degree of mechanical engineer.

Mr. Chewning started in the gas business as a cadet engineer with the Public Service Gas Company, Newark, N. J., where he soon advanced to superintendent of the Front Street gas works. In 1910 he became engineer of the Consumers Gas Company, Reading, Pa., and a year later joined the U.G.I. Company as assistant to the chief engineer of construction, whom he later succeeded. He was active as engineer in charge of electric and gas plant construction, later becoming vice-president of The U.G.I. Contracting Company, and continued with United Engineers & Constructors Inc. In 1938 he joined Day & Zimmermann Inc. as gas engineer.

Richard H. Lewis, of Ruud, Is Dead

Richard H. Lewis, chairman of the executive committee of the board of directors of Ruud Manufacturing Co., died in Pittsburgh, on November 13, after a short illness. He was 73.

Mr. Lewis was president of the company from 1944 until September 1951, when he made known his desire to assume a less strenuous part in the company's management.

With the company since 1914, and a member of its board of directors for 23 years, he played an important part in its development.

Wisconsin Association

(Continued from page 34)

standard merchandise and assuming full and complete responsibility for new automatic equipment on appliances that render their customers a more useful service.

Mr. Sorby stressed the importance of sales leadership at the local level by pointing up the need for intensive sales training programs among dealer groups locally, sponsored by the local utility.

E. N. Bonnett, Stacey Bros. Gas Construction Co., Cincinnati, described modern inspection and maintenance practices to protect gas holders. Extracts from his address follow:

"In many instances gas holders are neglected until someones' attention is forcefully directed to some failure which renders the structure unsafe. In order to prolong the life of a holder and to guard against failure, a well planned inspection and maintenance program should be followed at each plant.

"For many, one of the most troublesome problems in maintaining gas holders is that of preventing corrosion on the interior of the holder shells and crown. In recent years there have been quite a number of holder failures which can be attributed to excessive corrosion taking place on the interior metal surfaces. It is generally known that all holders sweat more or less during temperature variations and since the interior surfaces hold moisture and there is usually enough oxygen in the gas to start corrosion, the surfaces become pitted over a certain period of time.

"Considering the large number of holders which are in existence throughout this country today, the percentage of failures up to this time has been relatively small. However, since many of the existing units have been in continuous service for periods ranging from thirty to forty years, failures may well be expected to increase unless a regularly scheduled inspection and maintenance program is adopted to prevent them."

THE TOUGHER THE JOB
THE MORE WE CAN HELP

An outside viewpoint is often essential in a search for new ways of cost reduction, methods, management, organizational, or engineering problems.

Commonwealth specialists have a sound background in the various aspects of business operations. Valuable time of your executives may be saved by calling Commonwealth in on the job.

No matter whether the job is large or small, Commonwealth's ability may profit you.

Check the ways in which Commonwealth can contribute to the efficiency and economy of your organization. Write for booklet describing the many services available to you. Address: Commonwealth Services Inc., Department D3, 20 Pine Street, New York 5, N. Y.

INVESTIGATIONS • REPORTS • FINANCING • ACCOUNTING • SYSTEMS • TAXES • INSURANCE
PENSIONS • RATES • DEPRECIATION • VALUATIONS • DESIGN AND CONSULTING ENGINEERING
METERING • PURCHASING • INDUSTRIAL AND PUBLIC RELATIONS • MERCHANDISING • ADVERTISING

COMMONWEALTH SERVICES · INC. AND COMMONWEALTH ASSOCIATES · INC. ENGINEERING SUBSIDIARY

20 PINE STREET NEW YORK 5, N. Y. HANOVER 2-0170
7 HAYES STREET JACKSON, MICH. DIAL 8121
1025 CONNECTICUT AVE. N.W. WASHINGTON 6, D.C. STERLING 3363

ABILITY • EXPERIENCE • RESOURCEFULNESS • RESULTS

Tenn. Gas Transmission Names Additional Officers

W. C. McGee, Jr.

Joe J. King

Three new vice-presidents and a new treasurer were elected by the board of directors of the Tennessee Gas Transmission Company on November 12, it was announced by Gardiner Symonds, president.

W. C. McGee, Jr., general superintendent of the company's 2000-mile-long natural gas pipe line system, was made vice-president and general superintendent.

Joe J. King, formerly chief engineer, was elevated to vice-president in charge of engineering.

Carl Myers, formerly treasurer, was made vice-president in charge of the company's Commerce building and of company insurance.

Cecil C. Johnson, formerly assistant controller, was elected treasurer.

OTHER PROMOTIONS

It was also announced that Edward S. Murray has been promoted from assistant chief engineer to chief engineer and that E. E. Miller, in addition to his duties as vice-president of the Northeastern Gas Transmission Company, will also serve as assistant chief engineer of Tennessee Gas. Northeastern Gas is the New England subsidiary of Tennessee Gas. Earl McNeill was elected vice-president of the Tennessee Production Company, another subsidiary engaged in oil and gas exploration and production in the southwest. He formerly was general superintendent.

Mr. McGee and Mr. King have a broad background in the operating and engineering phases of natural gas pipe line systems. Mr. McGee is a graduate in civil engineering from Texas A & M while Mr. King is a graduate in mechanical engineering from the University of Texas. Mr. McGee joined Tennessee Gas as chief dispatcher in 1944 while Mr. King came with the company in 1946 as assistant superintendent of compressor stations.

Mr. Myers joined Tennessee Gas as controller in 1944 and became treasurer in 1947. Mr. Johnson came with the company as budget director in 1947 and has been assistant controller since the beginning of 1949.

Mr. Murray has been with Tennessee Gas since 1943, Mr. Miller since 1944 and Mr. McNeill since 1947.

Taylor G. Nelson Has Joined Minneapolis-Honeywell

Taylor G. Nelson

Taylor G. Nelson, formely vice-president and sales manager of the Titan Valve Company, Cleveland, has been appointed eastern sales manager for the Appliance Controls Division of Minneapolis-Honeywell Regulator Company, John E. Haines, vice-president, announced recently.

Mr. Nelson will be located in Honeywell's Cleveland office, and will have responsibility for the sale of water heater controls and other products of the division, except space heating controls, in the area east of the Mississippi, plus states bordering the Mississippi on the west.

He has had more than 15 years' experience in the gas appliance control field.

H. W. Milner Joins Bryant Heater As Manager, Special Acc'ts Div.

H. W. Milner

H. W. Milner has been appointed to the post of manager, special accounts division, of Bryant Heater Division of Affiliated Gas Equipment, Inc., according to a recent announcement by J. N. Crawford, director of sales.

Mr. Milner, who is generally known as "Tex" in the gas industry, will maintain his office at Bryant's headquarters in Cleveland.

He has a long background of experience in the gas industry, including service with government administrative agencies during World War II, vice-president in charge of sales, Heating Research Corp., and sales manager, Domestic Heating Division, Stewart-Warner Corp.

Special Booklet on Gas Ranges Aids Materials Allocation

An industry study stressing the importance of domestic gas ranges to the nation's defense efforts has just been distributed to top government officials to help them solve the problem of materials allocation.

The 22-page illustrated brochure, prepared under the supervision of the Domestic Gas Range division of the Gas Appliance Manufacturers Association, points up the fact that even as an army travels on its stomach, defense production begins at home with a hot meal.

The booklet, which went to legislators as well as allocation officials, brings out the fact that manufacturing the modern gas range requires less of the most critical defense materials than any other type of range.

"A GAMA survey," says Wendell C. Davis, chairman of the division's defense regulation committee, "shows that the average modern gas range requires only 1.3 pounds of copper and brass, 1.7 pounds of aluminum, and four-tenths of a pound of nickel."

The brochure quotes figures from GAMA showing that 28 million gas ranges are now in use across the country. But the organization points out that many have reached replacement age.

The government itself has figured that a minimum of 2,662,000 gas ranges will be needed during the next 12 months. But GAMA says that nearly eight million gas ranges now in service are over 12 years of age and that by the end of this year the total will have reached 9,625,000.

Injury Law Suits

(Continued from page 35)

of the alley was as safe as a smooth concrete sidewalk and she was required under the law to exercise the degree of care at this place, commensurate with the danger. See Batts v. Nashville, 22 Tenn. App. P. 427; Ritter v. Shelton, 135 Atl. 535 (Supreme Ct. of Conn.); Dupont v. Port Chester, 204 N. Y., P. 351; O'Donnell v. City of Butte, 211 Pac., P. 190, 32 Alr 1284.

Mrs. Hood knew of the mud in the alley-way and should have used ordinary care to avoid it by going outside or around the mud, and her failure to do so was contributory negligence as a matter of law. See Telegraph Co. v. Card, 8 Higgins, P. 294; Jones v. Countes Gas Co. (Penn.), 137A P 168 (Certiorari denied by U. S. Supreme Court); Marnig v. City of Billings, 142 Pac. (2d) 361 (Supreme Court of Montana); Burns v. City of Charlotte, 185 SE (NC) P. 443; Codey v. City of Barton (Mass.), 154 N. E. P. 753; Missouri Pac. R. R. v. Havens (Ark.), 261 SW P 31; Allhouse v. Burough of Wilkensburg (Sup. Ct. Penn), 22 A (2d) 756; Hart v. North Union Gas Company, 233 N. Y. S. 1; and Pearson v. Chicago, Ill. (Court of Appeals), 8 N. E. (2d) 556.

Not Sidewalk

Another argument which had considerable effect in winning a favorable verdict was the fact that Mrs. Hood did not slip and fall on the sidewalk proper but at the mouth of the alley or crosswalk, which location she was expected

by law to exercise a higher degree of care for her own safety than when walking on a sidewalk. In this respect the counsel argued that the mouth of an alley over which Mrs. Hood was walking is not a sidewalk, but a crosswalk, and that the city is not required by law to use the same degree of care to keep safe, or reasonably safe, crosswalks as with sidewalks. See Pequignot v. City of Detroit (Cir. Ct. of Appeals), 16 Fed. P. 211; Paul v. City of Detroit, 32 Mich. 108; Ritter v. Shelton, 135 Atl. P. 535 (Sup. Ct. of Conn.); and Batts v. Nashville, 22 Tenn. App. P. 427.

And further there is no actionable negligence on the part of a city by allowing not over two inches of smooth mud to accumulate at the mouth of an alley. See McCrady v. City of Memphis, 174 Tenn. 162; Brolin v. City of Independence (Mo.), 114 S. W. (2d) 199; Dillon on Municipal Corp., Sec. 1697, P. 2967; O'Redlly v. City of Syracuse, 49 App. Div. 538 (N. Y.); Varner v. City of Covington (Ky.), 160 S. W. P. 173; and City of Dayton v. Foe, 70 S. W. (2d) 961 (Ky.).

Hence, it is quite apparent that it is proper and at the same time advantageous to either a city or gas corporation to differentiate between a sidewalk and an alley, or crosswalk. This is so because, as above indicated, the principles of law are different which define the duty and degree of care which a pedestrian is legally obligated to exercise when walking on a sidewalk, a street, mouth of an alley, or crosswalk.

These important legal distinctions are recognized by the higher courts. For example in the case of Batts v. Nashville, 22 Tenn. Appeals, the Supreme Court said:

"Pedestrians usually notice depressions and minor defects at crossings in alleys and in gutters as their attention is directed to such places, and they are expected to use care commensurate with the risk, but all have a right to assume that concrete sidewalks are in ordinarily good condition."

And again see Ritter v. Shelton, 135 Atl. P. 535. This court said:

"Reasonable care is still the test, but among the circumstances which must enter very largely into determination of the question whether it has been exercised is the fact that the walk in question is a crosswalk and not a sidewalk."

Daylight Injuries

Modern higher courts consistently hold that there is required of pedestrians considerable relative care when walking at night time on either a sidewalk or crosswalk.

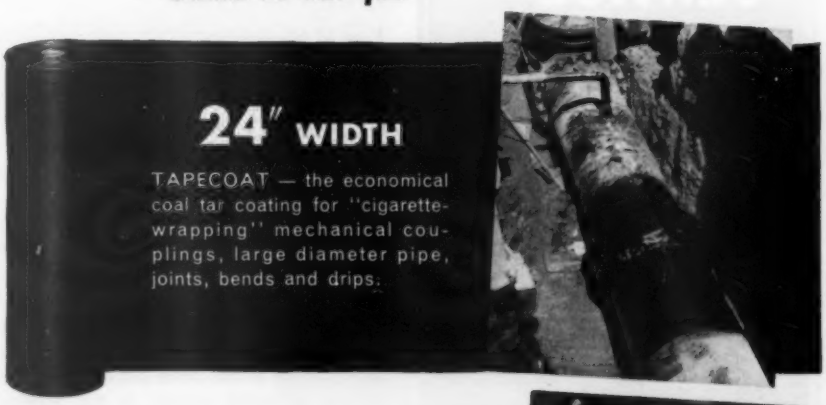
For example, in Jones v. Countes Gas Company, 137 Atl. P. 168, it was shown a pedestrian fell into an excavation in daylight. The testimony showed that

CUT CORROSION PROBLEMS DOWN TO SIZE...

WITH TAPECOAT*

—the Coal Tar Coating in Handy Tape Form

—Sized to the job



24" WIDTH

TAPECOAT — the economical coal tar coating for "cigarette-wrapping" mechanical couplings, large diameter pipe, joints, bends and drips.

18" WIDTH

TAPECOAT—the practical coal tar protection for "cigarette-wrapping" of large couplings, pipe bends, and joints on large diameter pipe.

6, 4, 3, and 2" WIDTHS

TAPECOAT — the distinctive, time-tested coal tar tape for spiral-wrapping welded field joints, service connections, pipe under streets and sidewalks, and pipe through building walls.

For more than 10 years, Tapecoat engineers have specialized in pipe joint protection. Call on them to help you meet your individual requirements. Write today for complete details.

The* TAPECOAT *Company

Originators of the Coal Tar Tape for Pipe Joint Protection

1529 LYONS STREET • EVANSTON, ILLINOIS

*Reg. U.S. Pat. Off.

A Complete
MAIN
TREATMENT
SERVICE

Prepare for Natural Gas

GPM PRODUCTS

"FLUSHALL"
— Dust Removal

"SOLVALL"
— Liquid Phase Gum

"SEALALL"
— Joint Sealing

"WETALL"
— Dust Laying

"FOGALL H"
— Hot Fogging

"FOGALL C"
— Cold Fogging

"IRON HYDROXIDE"
— Purification

Discuss your problems
with our engineers

GAS PURIFYING
MATERIALS CO.
3-15 26th Ave.,
Long Island City, N. Y.

there were no warnings or signs, or guards, or covering other than loose boards. The court said:

"It was at her own peril that she chose the way of reaching the sidewalk."

And again see the case of Marnig v. City of Billings, 142 Pac. (2d) P. 361. Here the testimony showed that a pedestrian alighted from a street car and stepped into a soft place in the street which was under repair. Even though there were no barricades, signs, and lights erected at the dangerous location, the court held the pedestrian not entitled to a recovery of damages for her injuries, because the testimony showed she knew the street was in a state of being repaired.

Law of Nuisances

A majority of higher courts hold that either a city or gas corporation is liable in damages to a pedestrian caused by its "nuisance." For example in Osborne v. Nashville, 182 Tenn. 197, the court said:

"The liability of an individual who without authority of law creates a dangerous condition in the highway, to a person injured thereby, is generally based on the theory that the defect or obstruction constitutes a nuisance, and accordingly it has been decided that the liability of such person is not affected by the question whether he was actually negligent. . . ."

In other words, if a pedestrian is injured through maintenance of a legal nuisance, generally the city or gas corporation will be held liable although the pedestrian may have been to some degree contributorily negligent.

Employes Create Danger

According to a late higher court decision, either a city or gas corporation is liable in damages for injuries to pedestrians where the testimony proves conclusively that the dangerous condition or defect which caused the injury was created by employes of the city or gas corporation.

In other words, a city or gas corporation is liable although its officials or employes have actual or constructed notice of such a defect which its own agents or employes have created.

See Nashville v. Nevin, 12 Tenn. App. 336, in which the court said:

". . . the jury might have been justified in finding negligence in the city in permitting an escape of water upon the sidewalk which would inevitably cause ice as soon as the weather became cold. This is not a case where the ice came from one of the natural causes, such as the freezing of rain or sleet. Here an escape of water was permitted during the winter. It might be harmless during warm winter weather but would certainly cause a dangerous place when the temperature would be below 32 degrees. There was constructive notice of the escape of this water, and of its flowing on the sidewalk, and knowing that a cold night might make this a cause of peril, the city might justly be found guilty of negligence by the jury."

Contributory Negligence

As explained, under ordinary circumstances, pedestrians are expected by law to use an "ordinary degree" of care to protect themselves against injury. In other words, no person is entitled to recover damages for an injury if the testimony indicates that a reasonably prudent person, under the identical circumstances, would have exercised such care that the accident or injury would *not* have occurred.

Therefore, under no circumstances will a higher court uphold a jury's verdict rendered against a gas company where the testimony proves that had the injured pedestrian used due care to protect himself no injury would have resulted. This same law is applicable to employes.

For instance, in United Gas Corporation v. Crawford, 172 S. W. (2d) 297, it was shown that a city decided to lower the grade of some of its streets, making it necessary for a gas company to lower its gas pipe lines located on those streets. When doing the work of lowering the pipe lines, the company employes caused a hole to be excavated. This hole was about six feet square and five feet deep. An employe standing in the street near the edge of the hole was shoveling dirt from the street to the sidewalk, when a portion of the edge caved in, causing him to lose his balance and fall into the hole.

The employe sued the gas company for heavy damages and alleged that the injury was caused by the negligence of other gas employes in failing to brace the walls of the excavation to prevent its caving.

The jury held that the gas company was negligent in failing to brace the walls of the hole and held the company liable in damages for injury sustained by the workman. However, the higher court reversed this verdict, and said:

"It clearly appears that respondent's (employe's) injuries were caused by his own act in getting too near the edge of the excavation with full knowledge of all the surrounding circumstances. Respondent (employe) had known for several days prior to the accident that the hole was there, and that it was not guarded or protected. Although he was fully aware of this condition and realized the danger, he nevertheless continued to work near the edge of the hole without protest. . . . It is quite clear that respondent (employe) was guilty

of contributory negligence as a matter of law and is not entitled to recover."

Must Prove Negligence

It is well established law that if an injured person fails to prove that his injuries resulted from negligence of the gas company, the latter will not be held liable. Furthermore, proof that gas company employes exercised reasonable care to prevent the injury, in combination with other relevant testimony, always results in a favorable verdict for the gas company.

For illustration, in Huber v. Philadelphia Gas Works Company, 50 Atl. (2d) 203, it was shown that employes of a gas company were engaged in laying gas pipes under a sidewalk, and in course of that work had dug a trench. The trench was about five feet deep and about three feet wide. It extended parallel with the curb. When gas company's workmen stopped working on that evening, the sidewalk was barricaded. Red lights were placed on the barricade and also red lights were placed along the trench sides.

The following morning a pedestrian was found lying in the trench. He was suffering from severe injuries. He died and his wife sued the gas company for damages.

In view of the testimony that the gas company's employes had taken precautions as above described to safeguard pedestrians from injuries, and no proof was given that negligence of the gas company's employes caused the accident, the higher court refused to hold the gas company liable, and said:

"The net result of the testimony is that nobody knows how (pedestrian) got into the trench or was injured. The burden of proof was on the plaintiff. She failed to prove that pedestrian's injury resulted from any breach of duty by defendant (gas company)."

Injuries in Buildings

The records of higher court decisions show that many persons are injured in buildings owned and occupied by gas companies. Generally these injured customers and persons cannot recover any damages if they fail to prove that authorized officials or employes of the gas company *knew* that the dangerous condition existed, or that the dangerous condition had existed for so long that company officials or employes could have discovered and remedied the dangerous condition by exercise of "ordinary care."

For illustration, in Fazio v. Stanley, 47 N. E. (2d) 957, it was discovered that a woman sued to recover damages for an injury when she fell upon the floor of the ladies' room. The injured person proved that the room contained a drinking fountain, and that there was water upon the floor which made the place dangerous and upon which she slipped.

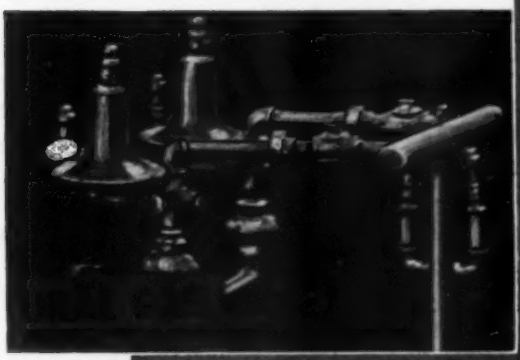
However, since the injured person failed to prove that the officials of the company knew that the drinking fountain was leaking and caused a slippery floor, the higher court refused to hold the injured person entitled to recovery damages.

Also, see Mandigo v. Hamid Company, Inc., 57 N. E. (2d) 553, where a person was injured when he slipped on candy which some unidentified person had dropped on the floor.

The higher court refused to hold the injured person entitled to recover damages because she failed to prove that the candy had been on the floor a sufficient length of time that the management or employes could have, by the exercise of ordinary care, discovered and removed the candy from the floor. This court said:

"There was no evidence that he (official) had seen the substance on which the plaintiff slipped, and the nature and condition were such that an inference would not be warranted that it had been on the floor so long that it should have been seen and removed."

A WIDER RANGE
... of Delivery Pressure Control



REYNOLDS HIGH PRESSURE LINE REGULATORS

in parallel hookup have an increased range of capacity as well as a wider range of delivery pressure control. This also provides greater margin for emergencies. On inlet pressure the range is up to 650 pounds. For outlet pressure, this unit assures absolutely accurate and dependable control from 2 to 100 pounds. This variance in outlet pressure is made by use of different sizes of diaphram cases and further flexibility in the spring type is possible by use of different strength springs.

BRANCH OFFICES

H. D. "MIKE" MEUFFELS
423 Dwight Building
Kansas City, Missouri

SEIDENGLANZ & CO.
2nd Unit, Santa Fe Building
Dallas, Texas

REPRESENTATIVES

EASTERN APPLIANCE COMPANY
Boston, Massachusetts

WALDO S. HULL
163 W. Queen Lane
Philadelphia, Pennsylvania

Reynolds Gas Regulator Co.
ANDERSON, INDIANA, U. S. A.

GAS CONTROL SINCE 1892

100% Natural Gas

(Continued from page 31)

four base gases to be practically the same in location on the chart and in shape. From these tests it was concluded that the four selected base gases would be interchangeable. On subsequent tests on actual appliance burners it was impossible to tell any difference between the various gases in their burning characteristics, appearance, or performance.

D. Substitute and supplemental mixtures

1. GENERAL

Now that the base gases had been selected and their performance had proved to be satisfactory, the next problem was to select substitute and supplemental gases. These were determined and tested in the same manner as the base gases were. For the study of this problem other charts were prepared as listed in Table 7.

For example, refer to Figure 7 which is the chart for catalytically reformed propane, propane, and air. By inspection, the point S for 800 Btu and 0.58 specific gravity (base gas characteristics) is seen to be below the gas mixture chart; that is, outside of the gas mixture triangle. This shows that catalytically reformed propane, propane, and air cannot be mixed in any combination to give 800 Btu and 0.58 specific gravity. However, by adding more propane and air the characteristics of the mixture can be changed to move the point upward, along the constant heat input (169 per cent) line until the composition falls within the triangle. For a mixture containing the representative 16 per cent of H_2 the point would be at S^1 with characteristics of 1070 Btu and 1.06 specific gravity.

This above example demonstrates the method in which all the other charts may be used.

2. SUBSTITUTE GAS MIXTURES

By definition *a substitute gas mixture* is one which can be substituted 100 per cent for the base gas. Tables 9 and 10 show some of these gases and their interchangeability characteristics. These mixtures are 100 per cent interchangeable with the base gases and may be substituted for them. On Table 9 are found these mixtures whose appliance performance is equal to the base gas. Table 10 contains those mixtures which might be used in 100 per cent substitution for the base gases but are on the verge of producing yellow tip flames on some burners. Their use for 100 per cent replacement of the base gases is recommended only during emergency conditions. However, they may be used with complete satisfaction when mixed with a small percentage of base gas.

3. SUPPLEMENTAL MIXTURES

By definition *a supplemental mixture* is one that can be used to supplement a base gas, but which is not 100 per cent interchangeable; that is, which is not a substitute gas.

Tables 11 and 12 list some of these supplemental mixtures which were studied in the Philadelphia Electric Company's problem. These mixtures are not satisfactory as substitutes for base gases because of yellow tip flame. However, they may be used in mixture with the base gases. The quantity of base gas required to produce the satisfactory mixture is shown in the tables.

On Table 11 are listed the supplemental gas mixtures at the lowest heating value at which they may be produced with 169 per cent heat input. This is the point where the mixture first comes within the lower boundary of the gas mixture chart.

Table 12 lists the supplemental gas mixtures which may be produced by going up the constant 169 per cent heat input curve until the lifting tendencies of

M-SCOPE Pipe Finder

LIGHTWEIGHT MODEL

One Man Operation On Every Application

HIGHLY EFFICIENT

IMMEDIATE SHIPMENT

Free Demonstration and Operating Instructions

Catalog No. 25M On Request

JOSEPH G. POLLARD CO., INC.

Pipe Line Equipment

New Hyde Park New York

LOWEST COST PIPE INSTALLATION...

2" to 24" BORES - Up to 250' long.

Send COUPON Today!

Hydrauger Corp., Ltd.
681 Market St., San Francisco, Calif.
Please send, without obligation to me, the HYDRAUGER BOOKLET which shows relative costs and speeds of BORING as well as specifications of various Hydrauger models.

NAME _____ STATE _____

ADDRESS _____

CITY _____

HYDRAUGER*

Reg. U. S. Pat. Office

UNDER STREETS
UNDER FREEWAYS
UNDER GARDENS
UNDER PAVEMENT

OPEN HOLE

HY-25A

*Earth Boring Tool

AVOIDS EXCESSIVE TRENCHING

Hydrauger bored holes for pipe installation invariably reduce costs 80% to 90% by eliminating trenching and back-filling to say nothing of man-hour labor savings and safety to highway traffic.

HYDRAUGER CORP. Ltd.
681 Market Street
San Francisco, California

the flames on the appliance burners are comparable to those of the base gases.

The numbers at the left of the tables in the column headed "chart number" refer to the numbers of the gas mixtures as listed in Table 7.

The lifting and yellow tip characteristics of several of these substitute and supplemental gas mixtures are shown on Figure 8.

a. Curve 1 is the base gas of coke oven gas, natural gas and air at 800 Btu and 0.58 specific gravity. This is the same point as was shown on Figure 6.

b. Curve 3 is for carburetted water gas, propane, and air. By comparing the relationship of the lifting line and the yellow tip line with the adjustment point it is seen that both lines are *above* the adjustment point. Therefore, this gas will give serious yellow tipping when put into the burners in place of the adjustment gas.

c. Curve 9 is for reformed natural gas, twin generator oil gas, and air. It will be seen here that the yellow tip line is just about on the adjustment point. This shows that it is a border line mixture. Table 11 shows that 10 per cent of the base gas should be added to it to be certain of eliminating all yellow tipping.

d. Curve 13 is for reformed refinery oil gas, refinery oil gas, and air. Comparing this with the adjustment point it shows that the yellow tip limit line is *below* the adjustment point, and therefore it should be a satisfactory substitute gas. This is confirmed by referring to Table 10.

4. CONCLUSION

In like manner curves were developed for all the mixtures which were studied. From this information production charts were prepared so that for any day the plant forces and the system operating forces know exactly what gases can be produced at any time regardless of the load or load conditions. This permits them to change operation quickly in case of the failure of any equipment, or of a curtailment of natural gas. We feel that we are in a fine position now for meeting any sendout that may be required under any operating condition.

(Part 3 will appear in January)

Bondurant Now Sales Manager Of Titan Valve & Mfg. Co.

C. W. Bondurant has been appointed sales manager of The Titan Valve & Mfg. Co., Cleveland, manufacturers of controls for water heaters and other appliances.

Mr. Bondurant, who has been with the company for many years, was formerly chief development engineer.

L. C. Roberts Is Adv't Director Of Lone Star Gas

L. C. Roberts has been appointed advertising director of Lone Star Gas Company, Dallas, according to an announcement by D. A. Hulcy, president of the company. Mr. Roberts succeeds the late James M. Floyd.

Mr. Roberts has been with Lone Star the past 18 years, all of which time has been spent in various capacities in the advertising department. In 1942 he was made advertising supervisor and in that position he initiated and carried through Lone Star advertising and sales promotion programs.

He is a past president of the Dallas Advertising League and in 1945 was voted the League's most valuable member. He recently accepted appointment to the advertising copy committee of the American Gas Association.

Commenting on Mr. Roberts' appointment, Mr. Hulcy said: "Because of Lone Star's ever-expanding advertising and merchandising programs to promote the sale of modern automatic gas appliances through more than 1,500 dealer stores and our own offices over the Lone Star system, we are fortunate in having a man whose entire business experience has been in the important field of merchandising."

SULFUR-FREE GAS

AT LOWEST COST

WITH IRON SPONGE

Iron Sponge is a concentrated purification material that operates with high efficiency at high or low pressures, has excellent capacity and activity, gives long service between foulings and is simply and quickly regenerated. This is why Iron Sponge has been preferred for H_2S removal for over 75 years.

CONNELLY, Inc.

3154 S. California Ave., Chicago 8, Ill.
Elizabeth, N. J. • Los Angeles, Calif.

NORWALK
DISC TYPE CHECK VALVE

Flanged and
Fabricated in steel

For GAS and AIR
LOW and HIGH PRESSURES

Can be supplied for use with any pressures. Easily lubricated through grease fitting. Indicator shows position of disc. Can be counter balanced for vertical jobs. Dash pot can be installed to prevent chattering when passing high velocity gas or air.

NORWALK VALVE COMPANY
South Norwalk, Conn.

Norwalk Makes 75½" Valve Of All Stainless Steel

Andrew Dolfini, production manager of Norwalk Valve Company, South Norwalk, Conn., stands alongside an interesting special valve Norwalk has just made for the growing titanium industry.

This valve is constructed entirely of stainless steel and therefore impervious to corrosive fumes. Mr. Dolfini thinks the valve typifies how manufacturers in the gas industry can meet demands for special products by defense plants.

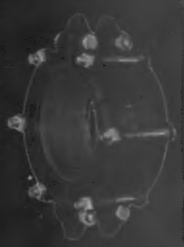
The valve is installed in the horizontal position in a stack. The side shown in the picture is on the bottom. In operation, the normal position is closed because of the slight vacuum under it. However, the valve must open quickly in case of positive pressure or a small explosion. For this reason, the valve is hinged in the middle with counter weights to help lift each half.

FOR REPAIRING BELL AND SPIGOT JOINT LEAKS...

SKINNER-SEAL Bell Joint Clamp for stopping bell and spigot joint leaks under pressure. Gasket is completely sealed: at bell face by Monel Metal Seal band—at spigot by hard vulcanized gasket tip.

AND BROKEN MAINS

SKINNER-SEAL Split Coupling Clamp. One man can install in 5 to 15 minutes. Gasket sealed by Monel band. Tested to 800 lbs. line pressure. A lasting repair. 2" to 16" incl.



M. B. SKINNER CO.
SOUTH BEND 21, INDIANA, U.S.A.

Servel Names New R. I. Distributor

Tracy & Co., Inc., of Providence, has been named distributor of Servel gas refrigerators and water heaters for the state of Rhode Island as well as Cape Cod and nearby islands. Announcement of the appointment was made by John K. Knighton, vice-president in charge of sales of Servel.

In addition to its new line of Servel products, the firm distributes Coleman heating equipment, Stewart-Warner radios and television sets, Domestic sewing machines, Universal ranges, and small appliances.

Continuous Sales Corp., N. Y., Is Coroaire Distributor

The Coroaire Heater Corporation, Cleveland, has announced the appointment of Continuous Sales Corporation, Long Island City, New York, as representative in the New York five borough and Northern New Jersey areas.

Al Cohen and Marvin Leffler of Continuous Sales Corporation have launched a sales program in line with development of gas home heating in the New York and Northern New Jersey area.

Financial Comment

(Continued from page 32)

go to the banks in ever increasing amount for funds.

Statistics compiled by the Securities and Exchange Commission show that the total of corporate cash and marketable securities increased by only $2.8 billion in the year ended June 30, 1951, in the face of a $19 billion increase in their current liabilities. Further strain on corporate funds is indicated in higher taxes, in the need to pay a far greater proportion of prior year taxes in the first half year than heretofore (35 per cent henceforth against 25 per cent previously) and in the prospect that, as financing cost increases, managements will endeavor to pay for a greater part of property additions and improvements from funds on hand.

While dividend payments for all of 1951 are expected to at least equal, and possibly exceed, the high level of 1950, it should be noted that distributions in the final half year may contract somewhat from a year ago, whereas in the first six months of 1951 they were well ahead of the corresponding 1950 period.

If dividend payments to common stockholders decline next year, as signs now indicate, financing through equities will become an increasingly difficult job. Utilities will be in a better position in this respect than the great body of industrial companies due to rate increases now coming through or applied for and due to ability to finance from corporate resources a greater portion of smaller prospective capital expenditures as material shortages and government restrictions force cutbacks in construction schedules. But any decline witnessed in prices for common stocks as a class is bound to have some repercussion on utility equities despite their continuing favorable characteristics.

Hope is entertained in some financial quarters that common stocks may come into demand by mutual savings banks in an effort to minimize the impact of the Federal taxes to which they are subjected under the Revenue Act of 1951. It is believed that some of these banks, where permitted by state law, would invest part of their funds in equities to obtain the 85 per cent exemption from income tax which corporations enjoy on dividend income.

The wish in this respect might prove to be merely the father to the thought, however, as was the case when life insurance companies were expected to flock into the common stock market following action of the New York State Legislature about a year ago making it permissible for life insurance companies in the state to invest a maximum of three per cent of their assets in common stocks.

This much must be said for utility common stocks. They have had the benefit of little or no speculative interest and their market action over the past year has been eminently satisfactory in view of the tremendous surge of stock purchasers into speculative and dynamic situations aided or likely to be aided either by war developments or by opening up of new oil and gas areas.

The action of utility companies in obtaining a large amount of their new capital needs from sale of common stocks also has exerted pressure on prices for their shares. With construction budgets in many instances now being curtailed from their previous record high levels, this pressure of new offerings should ease, aided by financing of a greater volume of construction from corporate funds.

With scant exception the yields available at prevailing market prices compensate for such uncertainties as might exist in the general market picture and utility managements constrained to or desirous of obtaining new common stock money should experience no great difficulty in carrying out their financing in this manner and on a satisfactory basis.

Selas Issues New Booklet On Heat Processing

"Heat Processing . . . with the most advanced techniques and equipment," a new bulletin issued by Selas Corporation of America, approaches heat processing through five basic questions: what is to be heated, what sections are to be heated, why the material is to be heated, to what temperature or temperatures, and the heating time. The bulletin illustrates the application of high-production heating principles to solid and fluid products ranging in size from mill operations to delicate enameled pieces. The bulletin, No. S-7.1, is available upon request to Selas Corporation of America, Philadelphia 34.

International Gas Conference Will be Held in June

The Fifth International Gas Conference will be held at Brussels from June 16 to 22, 1952, according to an announcement by the International Gas Union.

M. K. Griggs Co. Now Represents Eclipse Fuel at Houston

Eclipse Fuel Engineering Co., Rockford, Illinois, manufacturers of industrial gas equipment, announce the appointment of M. K. Griggs Company, 2801 San Jacinto, Houston, as representative for the Houston region.

Principals of the Griggs company are M. K. Griggs and B. W. Wallin. Both men have had extensive experience in the heating and engineering fields.

CHARLES R. BELLAMY

NATURAL GAS—MANUFACTURED GAS AND MIXED GAS PROBLEMS

44 Prospect Ave. Montclair, N. J.

Phone—Montclair 2-3692

LP-GAS EQUIPMENT & CONTRACTING

More than 70 Peacock Plants prove . . .

"There's No Substitute For Experience"

PAUL E. PEACOCK, JR.

Box 268, Westfield, N. J. Westfield 2-6258

E. Holley Poe & Associates

(ROBERT M. POE)

Natural Gas Consultants

Venezuelan Research & Development Corp.

1 WALL ST. NEW YORK 5, N. Y.

CONVERSIONS AND SURVEYS, Inc.

Gas Conversion Specialists

Conversion without Confusion

90 BROAD STREET NEW YORK 4, N. Y.

HAROLD MOORE

Consulting Engineer

SPECIALIST IN PLANT CONVERSIONS TO HIBTU OIL GAS

30 Vesey St., New York 7, N. Y. Phone WOrth 4-3473

LP-GAS INSTALLATIONS

Contracting Consulting

LP-GAS SPECIALISTS

H. EMERSON THOMAS AND ASSOCIATES

Box 270, Westfield, N. J. Westfield 2-2300

COAL AND COKE HANDLING

Complete engineering and installation service for coal and coke handling, screening, crushing, skip hoists and storage bins, including alterations to existing conveying and screening plants.

ROBINS ENGINEERS DIVISION

HEWITT-ROBINS INCORPORATED

157 Chambers Street New York 7, N.Y.

DRAKE & TOWNSEND INCORPORATED

GAS CONSULTING DESIGN ENGINEERING CONSTRUCTION

DRAKETOWN 2999

PROPANE PLANTS

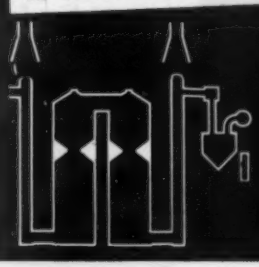
11 WEST 42ND ST NEW YORK 18, N. Y.

SEMET-SOLVAY

ENGINEERING DIVISION

Allied Chemical & Dye Corporation

40 RECTOR STREET · NEW YORK 6, N.Y.



- BLUE GAS PLANTS
- WATER GAS MACHINES
- WASHER COOLERS
- CHARGING MACHINES
- GAS PURIFIERS
- CONDENSERS
- WASTE HEAT BOILERS
- PRODUCER GAS PLANTS
- HIGH BTU OIL GAS PLANTS

YOURS—without extra charge:

The big brand new 1951 edition of

AMERICAN GAS HANDBOOK

Offered with your new or renewal subscription to

AMERICAN GAS JOURNAL

CONVENTION CALENDAR

January

21-23 AGA Home Service Workshop, Drake Hotel, Chicago.

28-30 American Society of Heating and Ventilating Engineers, St. Louis.

March

10-15 National Association of Corrosion Engineers, Galveston, Tex.

27-28 Oklahoma Utilities Association, Biltmore Hotel, Oklahoma City, Okla.

27-28 New England Gas Association, Annual Meeting, Hotel Statler, Boston, Mass.

31-April 2 Mid-West Gas Association, Annual Meeting, Hotel Radisson, Minneapolis, Minn.

April

3-5 Florida-Georgia Gas Association and Florida LP-Gas Association, Joint Meeting, Soreno Hotel, St. Petersburg, Fla.

4 Maryland Utilities Association, Annual Convention, Lord Baltimore Hotel, Baltimore, Md.

7-9 National Conference of Electric and Gas Accountants, Hotel Commodore, New York.

7-10 AGA Distribution, Motor Vehicles and Corrosion Conference, Benjamin Franklin Hotel, Philadelphia.

8-10 Southwestern Gas Measurement Short Course, University of Oklahoma, Norman, Okla.

SUPERIOR
METERS

RESPECTED BY
TWO GENERATIONS
OF METER MEN

★

ALL SIZES
5B TO 75C

★

PARTS—REPAIRS
DIAPHRAGMS

★

OVER 1,000,000
SUPERIOR METERS
ARE OUR BEST SALESMEN

SUPERIOR
METER COMPANY, INC.
167 41st ST., BROOKLYN 32, N.Y.

Classified

Services Offered:

14 years experience on Gas and Water distribution and Utilization, Supervisory and Managerial experience, desiring to enter sales work. Preferred location Mid-West or Mid-North-West. Address Box 236, c/o American Gas Journal, 205 E. 42nd St., New York 17, N. Y.

WANTED

Five new or used high pressure gas storage tanks with working pressure of 100 pounds. Diameter 8-10 ft., 30-40 ft. long. All welded or riveted construction. Contact Purchasing Dept., City of Clearwater, Florida.

COMPANY REPRESENTATIVE

Position open in sales by a nationally known manufacturer of thermostats for gas and electric hot water heaters, territory open west of the Rocky Mountains. Must be aggressive, hard-hitting, and be interested in increasing number of customers and have an engineering educational background. Salary or commission commensurate with ability. Manufacturers agents with competent sales force will also be considered, exclusive territory. Address Box 238, c/o American Gas Journal, Inc., 205 E. 42nd Street, New York 17, N. Y.

FOR SALE

Two new 30,000 gallon Propane Storage Tanks. January shipment. Box 239, c/o American Gas Journal Inc., 205 E. 42nd Street, New York 17, N. Y.

INDEX TO ADVERTISERS

Blaw-Knox Div. of Blaw-Knox Co. 9
Buell Engineering Co. 8
Cast Iron Pipe Research Association, The .. 4-5
Chaplin-Fulton Co. ..... Inside Front Cover
Commonwealth Services, Inc. 39
Connelly Inc. 45
Empire Stove Co. 2
Fisher Governor Co. 6
Gas Machinery Co., The 7
Gas Purifying Materials Co., Inc. 42
General American Transportation Corp. Inside Back Cover
Hydrauger Corp. 44
Natural Gas Odorizing Co., Inc. 1
Norwalk Valve Co. 45
Pollard Co., Joseph G. 44
Reynolds Gas Regulator Co. 43
Rockwell Manufacturing Co. 24-25
Safety Gas Main Stopper Co. 48
Selas Corp. of America 12
Semet Solvay Engineering Division, Allied Chem. & Dye Corp. 47
Skinner Co., M. B. 46
Sprague Meter Co. ..... Back Cover
Superior Meter Co. 48
Tapecoat Co., The 41
United Engineers & Constructors, Inc. 11
Vulcan Rubber Products, Inc. ..... Front Cover

The Reliable Shut-Off for Street Mains

THE GOODMAN STOPPER

Now has the "Z" handle for easy manipulation. When locked in place it holds. Stopper cannot slip. Gas cannot pass. Adjusted in 30 seconds.

Ask for circulars on this and other distribution equipment.

Nearly a half century of service to the Gas Industry.

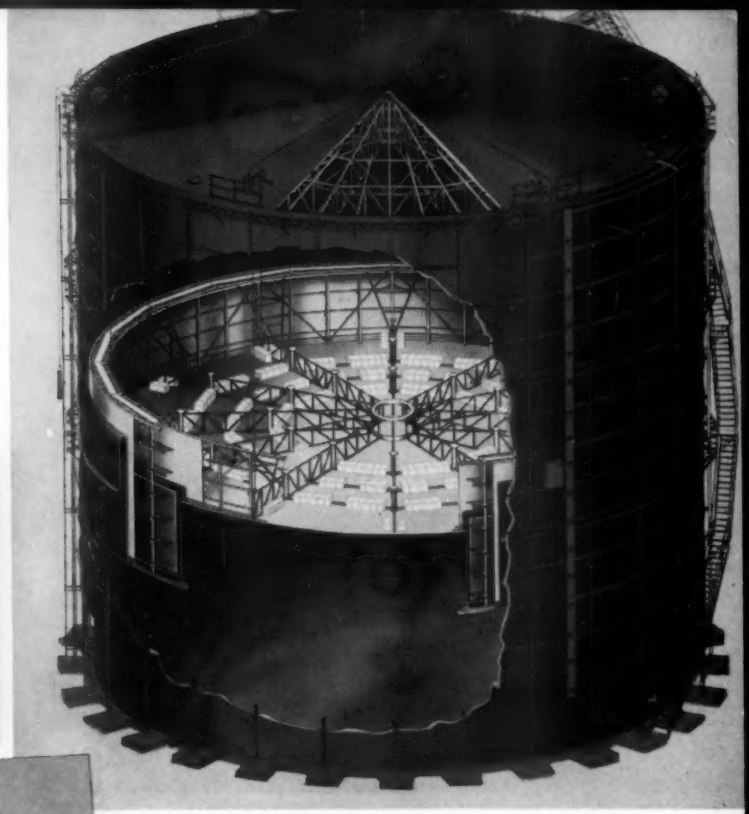
Safety Gas Main Stopper Co.
523 Atlantic Avenue, Brooklyn, New York

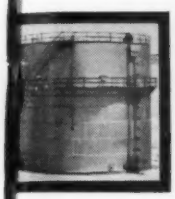
JOURNAL GAS FLOW COMPUTERS

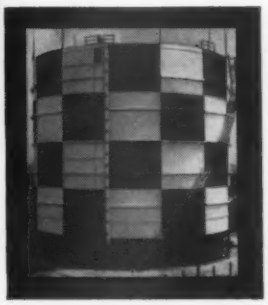
For Low Pressures - 10 to 500M cu. ft. of gas per hour
For High Pressures - 100 to 10MM cu. ft. of gas per hour

The computers are printed on heavy durable plastic, enclosed in leatherette cases with complete instructions for their use. **Price - $5.00**

Published and Sold Only by
AMERICAN GAS JOURNAL
205 East 42nd St. New York 17, N. Y.







safe, simple, 50 built *in three years*

See American Gas Association Builder's Committee Report (May, 1951)

As gasholders go, the Wiggins has a remarkably simple design. It has none of the complicated mechanisms of old-type gasholders. No materials that can be harmed by weather. Wiggins is the ONLY gasholder that uses no water, no tar, no grease. Wiggins assures no weather worries, no operating costs, no maintenance problems. It's the only gasholder with an absolutely dry, frictionless seal.

Designed by the famous conservation authority, John Wiggins. Built and erected by General American.

The frictionless piston rises and falls with changes in the gas volume. The gas tightness and impermeability of the Wiggins dry seal has been proved in actual operation.

Can be built to any capacity. Old gasholders can be converted and capacity increased as much as 50%.

write for new bul... WG22

for industrial and chemical process gases

GENERAL AMERICAN TRADE MARK

GENERAL AMERICAN
TRANSPORTATION CORPORATION
135 South LaSalle Street, Chicago 90, Illinois

Branch Offices: Buffalo • Cleveland • Dallas • Houston • Los Angeles • New Orleans • New York • Pittsburgh • San Francisco • Seattle • St. Louis Tulsa • Washington ★ **Export Dept.:** 10 East 40th Street, New York 17, New York ★ **Plants:** Birmingham, Ala. • East Chicago, Ind. • Sharon, Pa.

We wish you a Merry Christmas and extend to you our best wishes for a Happy and Prosperous New Year.

The Sprague Meter Company

BRIDGEPORT, CONNECTICUT

DAVENPORT, IOWA HOUSTON, TEXAS
LOS ANGELES, CAL. SAN FRANCISCO, CAL.